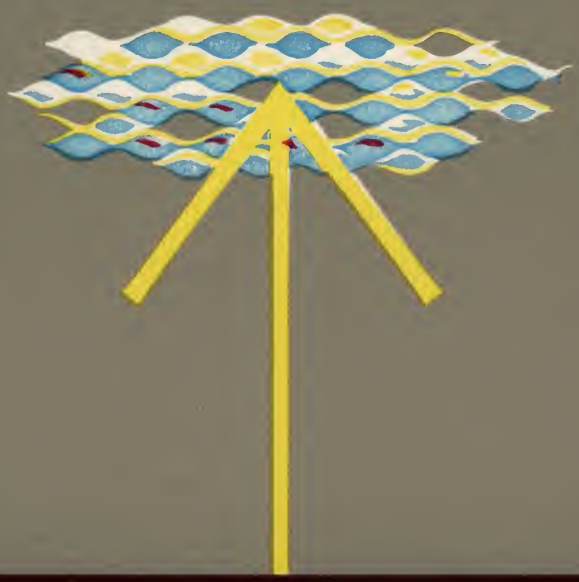
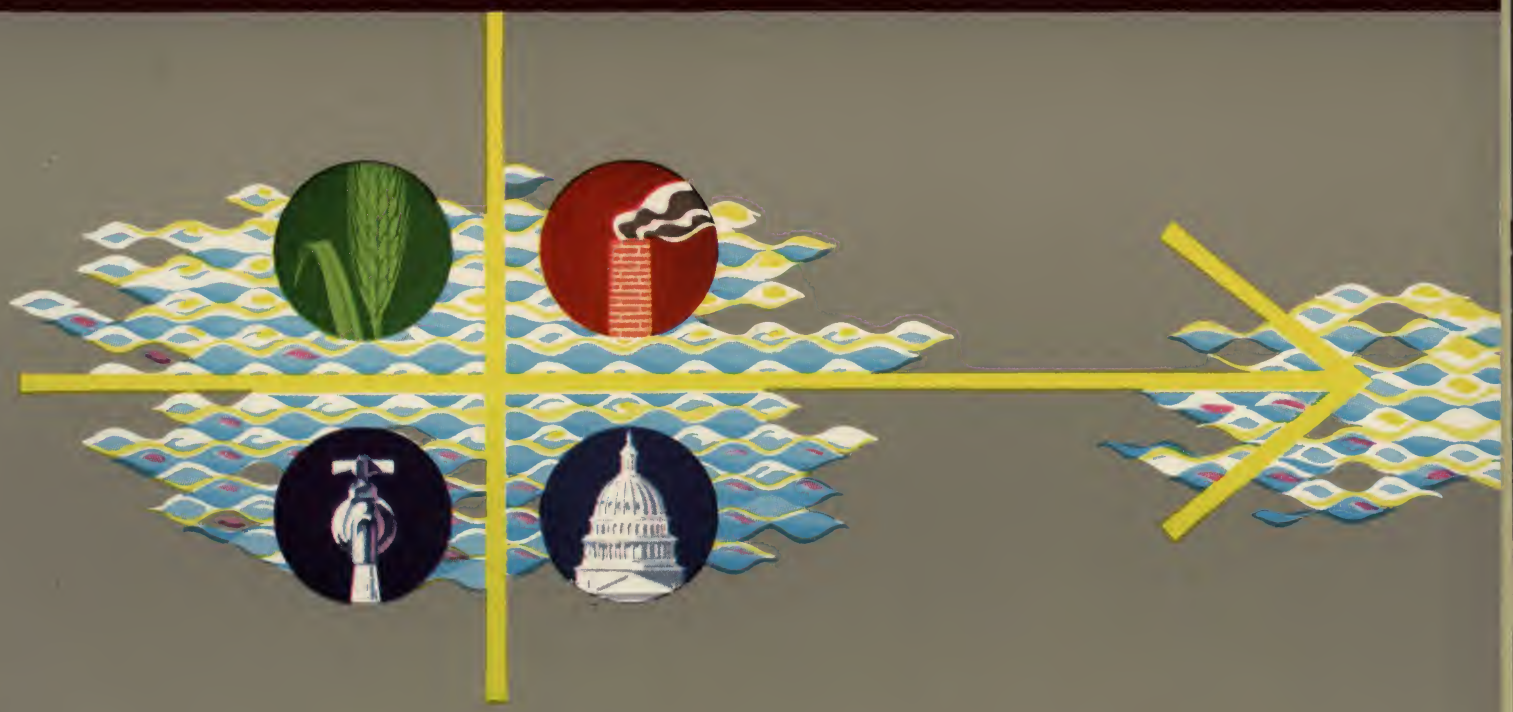
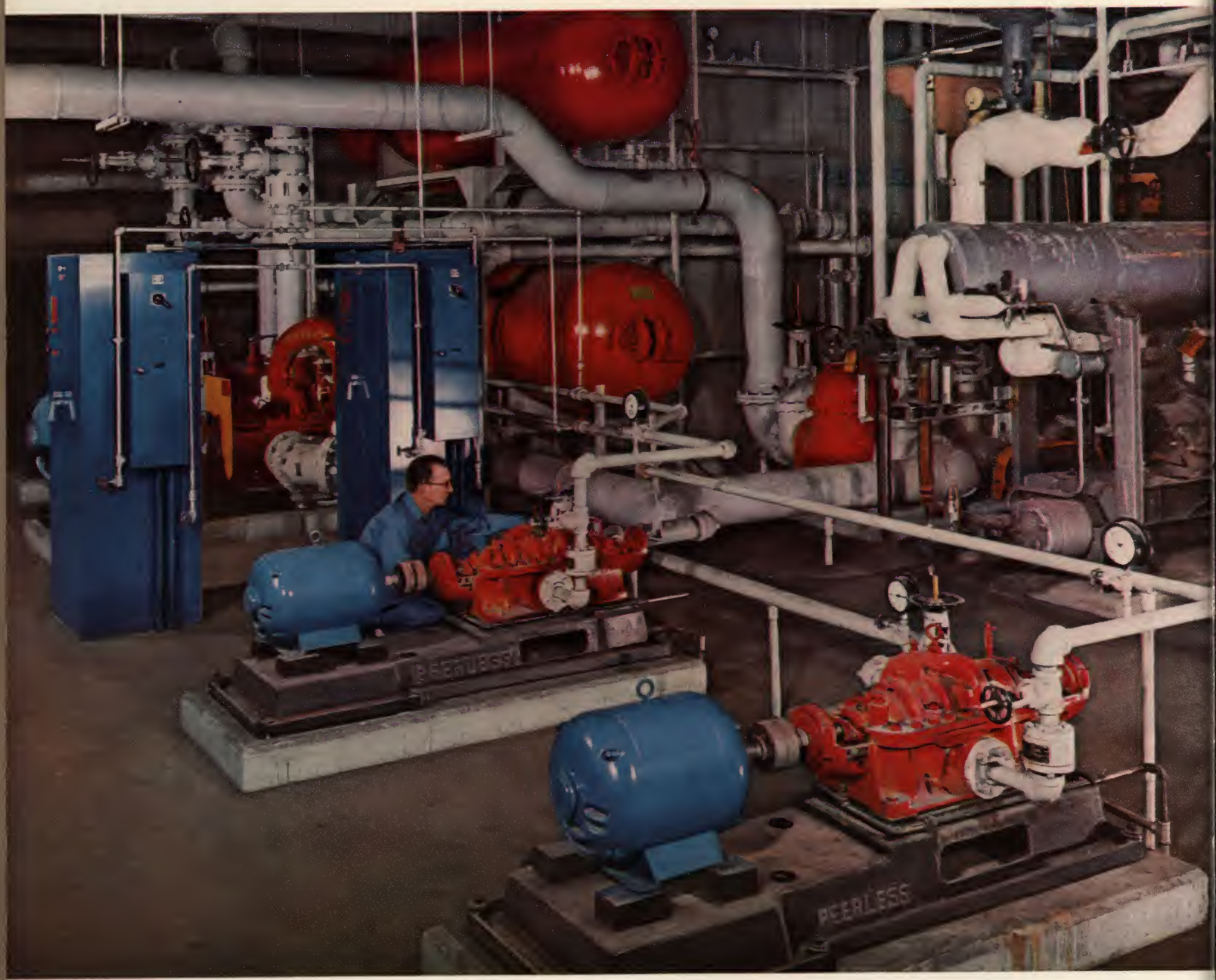


Peerless Pumps



PRESENTING



PEERLESS — AMERICA'S LARGEST SELLING FIRE PUMPS, INSTALLED IN NEW PRUDENTIAL INSURANCE COMPANY BUILDING, CHICAGO, ILLINOIS

Peerless Pumps...

A comprehensive catalog of vertical and horizontal pumps manufactured by

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Plants at: Los Angeles 31, California and

Indianapolis 8, Indiana

Offices and Distributors in Principal Cities of the

United States and Foreign Countries

BULLETIN NO. B-127

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In the event of shortage of critical materials Peerless reserves the right to substitute such materials as may be necessary. Every effort will be made to maintain the usual high quality of Peerless products.

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CLASSIFYING PEERLESS VERTICAL PUMPS

Composite charts showing application of many Peerless Vertical Pumps by broad Head and Capacity Ratings.

In its designation of vertical pumps, Peerless includes vertical deep well turbine pumps, close coupled vertical turbine pumps, vertical gasoline and fuel transfer turbine pumps, vertical turbine (Underwriters' approved) fire pumps, the Peerless Champion pump, a vertical deep well pump for small diameter shallow or deep wells, the Peerless Hi-Lift, a deep well pump with an unique positive displacement pumping action, the Peerless Hydro-Foil pumps (propeller and mixed-flow types) for pumping from surface water sources.

To graphically illustrate the size of each of these various pumps in the line of vertical pumps, the schematic silhouettes at the right reveal not only a capacity size relation, but in general show application possibilities.

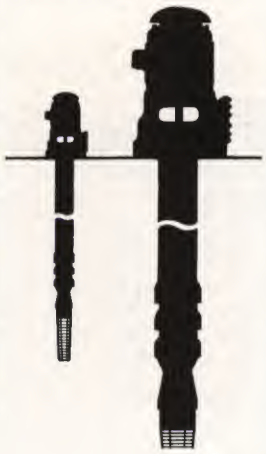
The application of each of these pumps is outlined briefly in the diagrammatic schemes at the right.

The charts below show specific capacity and head ranges for each of the pumps.

From these diagrams a tentative selection of the pump which best fits your needs can be made and its description can be read on the following pages.

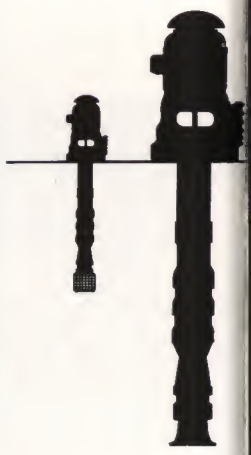
DEEP WELL TURBINE

A vertical rotative shaft turbine pump for pumping a water supply from deep drilled wells 6" in diameter and larger. A choice of oil lubricated or water lubricated types available. Broadest range of capacities: up to 30,000 gpm. Broadest head range: up to 1000 feet or more. All types of drive.

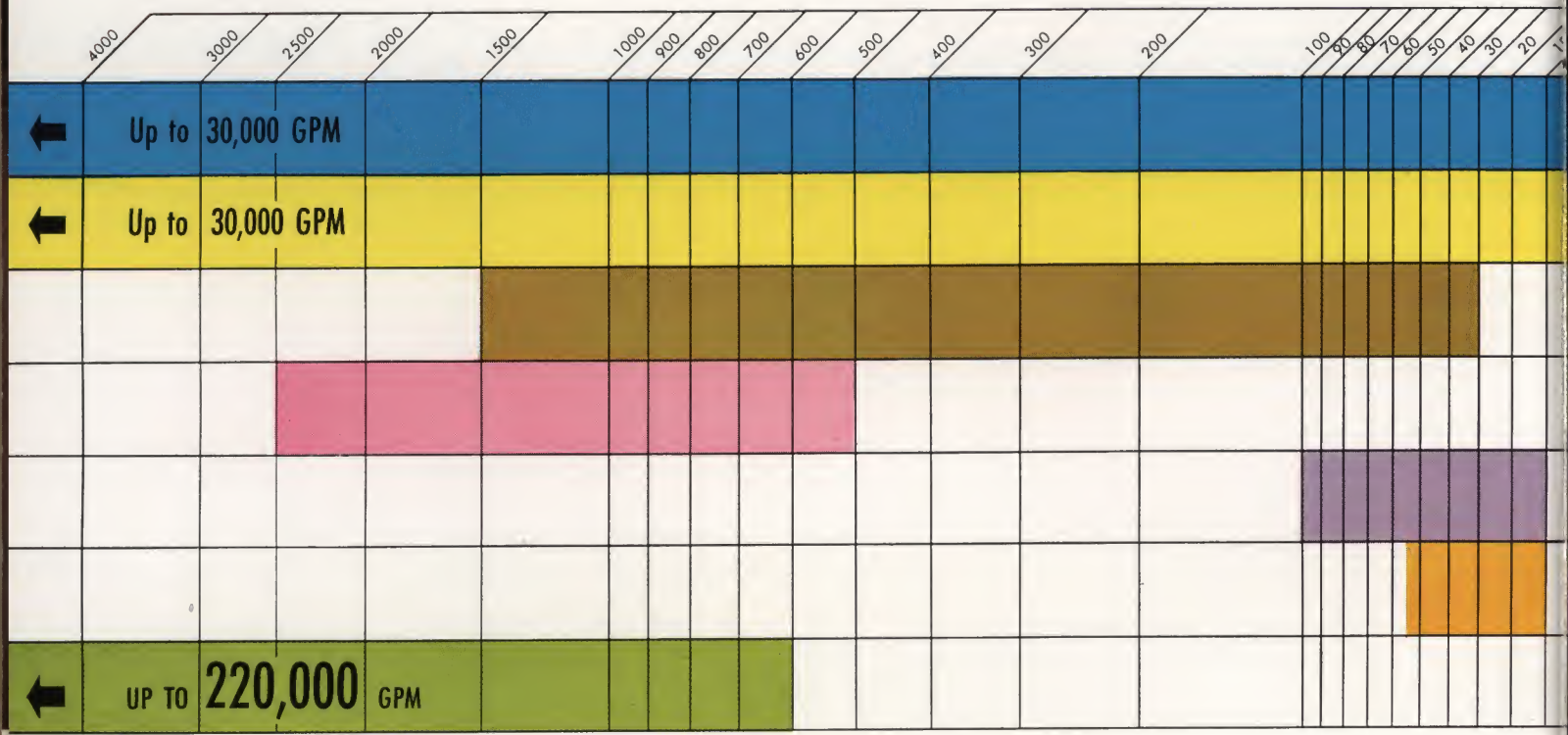


CLOSE COUPLED TURBIN

A vertical rotative shaft turbine pump for pumping water from surface sources, such as sumps, pits, basins, reservoirs, rivers, lakes, ponds. Capacities: up to 30,000 gpm; heads: up to 1000 ft. All types of drive.

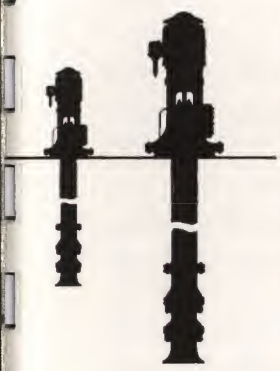


CAPACITY *(IN GALLONS PER MINUTE)*



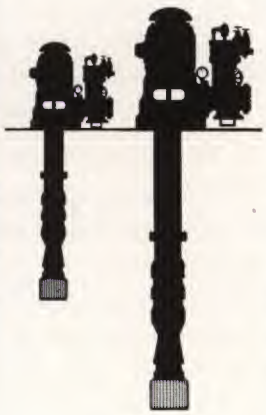
GASOLINE AND FUEL

A vertical rotative shaft turbine pump for pumping gasoline, distillates, fuel oil and similar petroleum products in marine or airport or similar service. Capacity ranges: up to 1500 gpm; heads: up to 300 ft. Explosion-proof electric drive is standard.



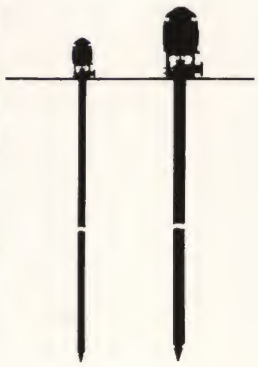
FIRE

Underwriters' approved vertical rotative shaft pump, a modification of the close coupled turbine pump, which, with proper fittings, provides positive protection pumping equipment for commercial and industrial risks. Capacities: 500 to 2500 gpm; heads: 100 to 125 pounds.



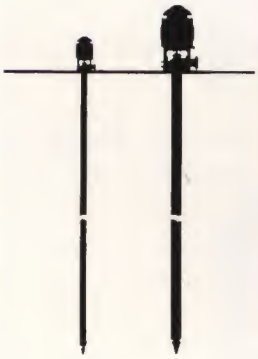
CHAMPION

A vertical rotative shaft turbine pump for pumping water from shallow and deep drilled wells of 4" inside diameter and larger. Capacities: up to 100 gpm; heads: up to 300 ft. Electric, right angle gear and belted drives available.



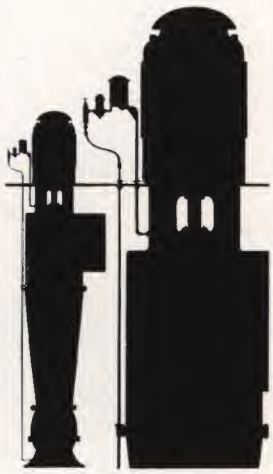
HI-LIFT

A vertical rotative shaft pump with an unique positive pumping action for pumping water from deep drilled wells, 4" inside diameter and larger. Heads: up to 1000 ft.; capacities: up to 55 gpm.

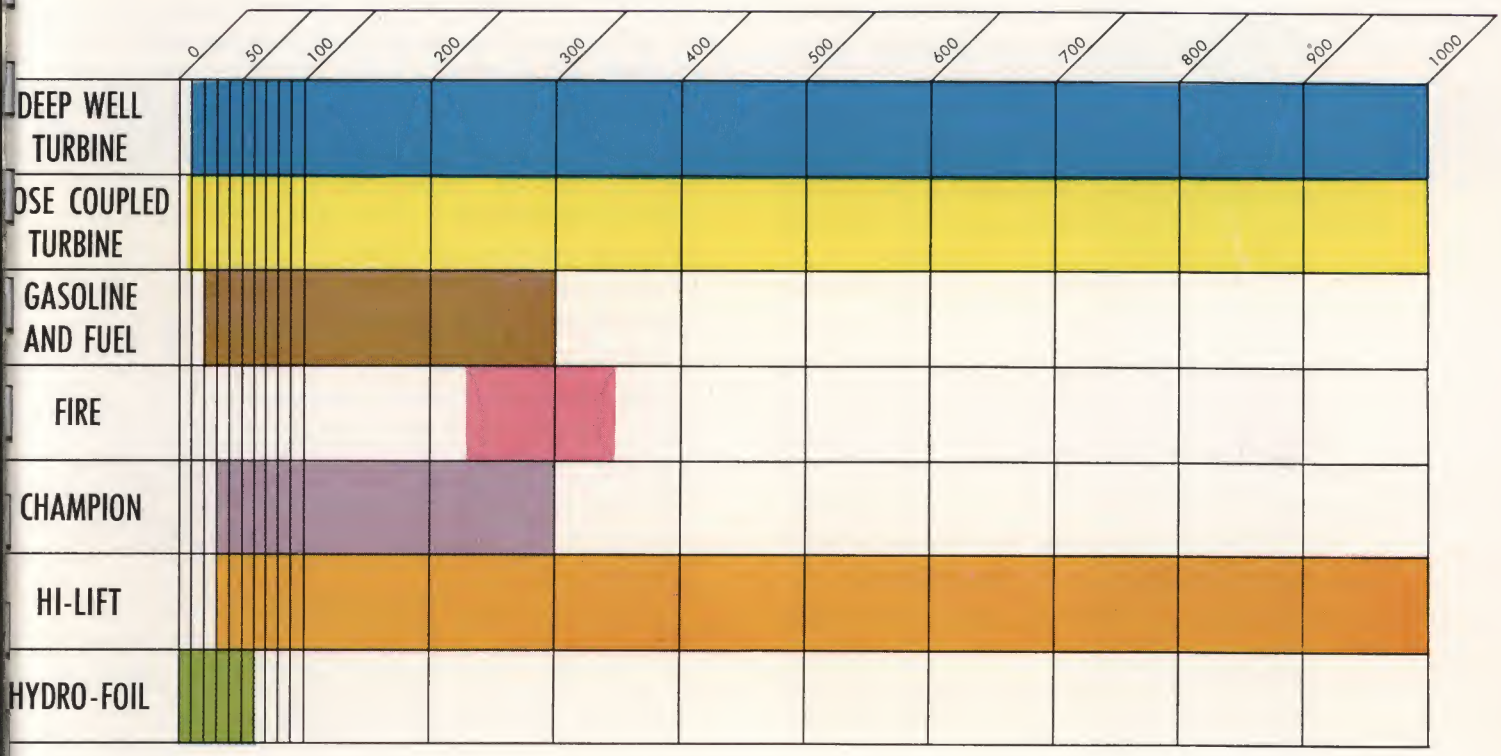


HYDRO-FOIL

Vertical rotative shaft pumps of either the propeller or mixed-flow types for pumping water from surface sources such as lakes, rivers, canals, ponds or for drainage or pumping industrial waste. Capacities range up to 220,000 gpm; heads range 2 to 60 ft.



HEAD *(IN FEET)*



PEERLESS VERTICAL TURBINE PUMPS

With a choice of OIL LUBRICATION or WATER LUBRICATION

For application to wells 1000 feet or more in depth for supplying water in quantities up to 30,000 gpm.

Also available in close-coupled design for installation in short or medium settings for pumping from surface water sources.

The vertical rotative shaft deep well turbine pump, first developed for installation in the arid farming regions to tap underground water sources, now is widely and successfully used and equally highly regarded by industrial, municipal, commercial and domestic users.

In planning the pattern of progress of the deep well turbine pump, Peerless Pumps established itself early in the 1920's by strict adherence to the simple phrasing of a guiding motto—"a good well deserves the best pump."

However, on location, the outstanding features of "the best pump" are not easily discernible. Inspection of a deep well turbine pump installation reveals only the pump's driver and the pump's discharge casting or base. The "pump" itself is underground, hidden from view.

Hence, a pump's true worth and value, its fine details of design and manufacture, its operative economy and longevity must, of necessity, be explained by words and illustrated by proof of performance for other owners.

Because a visit to Peerless' two modern manufacturing plants at Los Angeles and Indianapolis to see the step-by-step procedure in manufacturing Peerless Pumps is not ordinarily undertaken, this comprehensive catalog is another way of pictorializing the steps from analysis of the pumping application through the specifying of Peerless Pumps.

Agricultural and industrial water costs money. The receding water table in recent years in nearly all areas of the United States has added to the cost of water pumping and production. To the challenge of building the best pump, Peerless has also met another, that of measurably cutting pump overhead **—underground.**

How Peerless has accomplished this—how Peerless has attained a leadership in the field of turbine pump manufacture is ably demonstrated on succeeding pages. Remember that Peerless' position of leadership is not an impression created by promotion or publicity, but is a solid fact, rooted in the arithmetic of producing more water for less cost over longest periods of time. This is proved by its enviable sales record, for only Peerless offers America's largest selling deep well turbine pumps.

It is a leadership established by successfully answering the questions—how much does water cost and will it cost less with a Peerless deep well turbine pump. Water does cost less with a Peerless Pump because 1) its initial cost is competitive, 2) its design features result in mechanical perfection, 3) its manufacturing and assembly techniques are flawless, 4) superior inspection and testing assures a uniformly high quality product, 5) its efficiencies are maintained over extended pumping periods, 6) its performance in the field matches or exceeds customer requirements, and 7) its records of long service life are outstanding within the turbine pump industry. Endorsement by owners using Peerless Pumps in all types of services will confirm this Peerless superiority.

With the reading of this illustrative demonstration we feel you will agree that you can buy and install Peerless with the confidence that a good well deserves the best pump—a Peerless Pump.

THE PRINCIPAL PARTS OF A PUMP

A VERTICAL TURBINE PUMP is a vertical shaft centrifugal or mixed flow pump with rotating impeller or impellers, with discharge from the pumping element co-axial with the shaft. The pumping element is suspended by the conductor system which encloses a system of vertical shafting used to transmit power to the impellers, the prime mover being external to the flow stream. The unit is used for pumping from open pools or closed-suction systems.

The modern deep well vertical turbine pump consists essentially of three major elements—the head and driver assembly, the column and shaft assembly, the pump bowl assembly.

The head and driver assembly is made up of the driver and the discharge casting or base, from which the column and the bowl assembly are suspended. The discharge casting includes the discharge elbow, which directs the fluid into the desired piping system. In the illustration at the right of a typical Peerless deep well turbine pump the driver is a vertical hollowshaft electric motor. Other types of drives, which the discharge casting is built to receive are: vertical hollowshaft right angle gear drive, vertical hollowshaft V- or flat-belt drive, flexible coupling drive employing a vertical solid shaft motor, and combination drivers, providing means for operating the pumping unit with various types of drives.

The column and shaft assembly consists of the column pipe which suspends the pump bowl assembly from the head assembly and serves as a conductor for the fluid from the pump bowl assembly to the discharge elbow. Contained within the column pipe is the line shaft which transmits the power from the driver to the pump shaft. The line shaft is steadied throughout its length by means of bearings and may be enclosed in a shaft enclosing tube and lubricated with oil or it may be open, and lubricated with the fluid being pumped. The difference between these two methods of lubrication is comprehensively explained on succeeding pages.

The pump bowl assembly is either a single or multi-stage, centrifugal or mixed flow vertical pump with discharge co-axial with the shaft. It has semi-open or enclosed impellers. Assemblies are constructed for use with either open or enclosed line shafts.



THE HEAD ASSEMBLY

DRIVER

DISCHARGE CASTING OR BASE

COLUMN PIPE

THE COLUMN AND SHAFT ASSEMBLY

LINE SHAFT

OIL ENCLOSING TUBE IF OIL LUBRICATION IS EMPLOYED

BEARINGS
SEE PAGE 15 FOR BEARING DETAILS

PUMP BOWLS

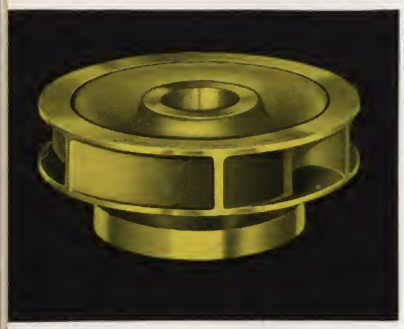
THE PUMP BOWL ASSEMBLY

IMPELLERS HOUSED WITHIN BOWLS

SUCTION MANIFOLD

SUCTION STRAINER

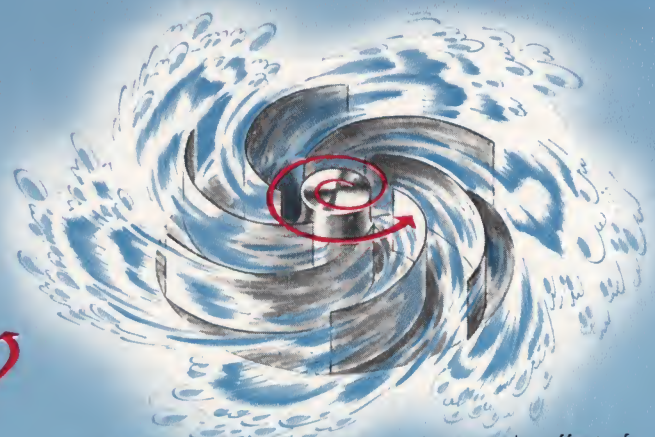
A SIMPLE STUDY IN CENTRIFUGAL WATER LIFTING



A vertical deep well turbine pump is, by definition, a vertical rotative shaft **centrifugal** pump with rotating impeller or impellers suspended from the pump head by a column or eduction pipe which also serves as a support for the vertical rotative shaft and shaft bearings. A centrifugal pump, as its name implies, employs centrifugal force to develop pressure to force a liquid from a lower to a higher level. In its basic form the pump consists essentially of, as shown at left, an impeller which rotates in an enclosed housing or bowl. Water flows into the bottom of the housing surrounding the impeller and is picked up by the rotating vanes of the impeller, accelerated to a high velocity and discharged by centrifugal force into the bowl vanes, which re-direct the water from a radial direction to an axial direction and thence to the column pipe and up to the discharge. As the liquid is forced

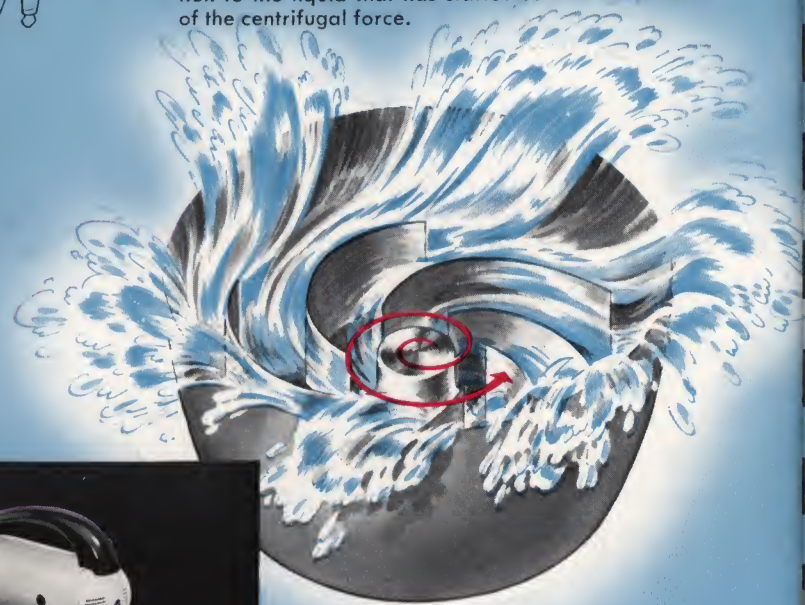


In the drawing above the contoured paddles, simulating the vanes of a turbine pump impeller, are immersed in a still body of water. Just as the familiar weight on the end of the string will be forced to the outside when rotated, so when the paddles are rotated the water is forced outward, due to centrifugal force.



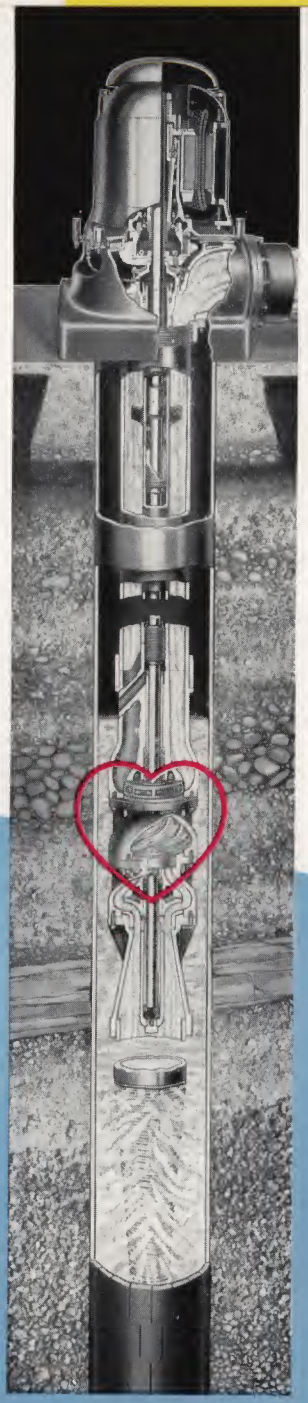
Here in the drawing above can be seen the effect of centrifugal force due to the paddles or vanes of the impeller as they rotate in the water at high speed. The problem now is simply to give control and direction to the liquid that has started to flow as a result of the centrifugal force.

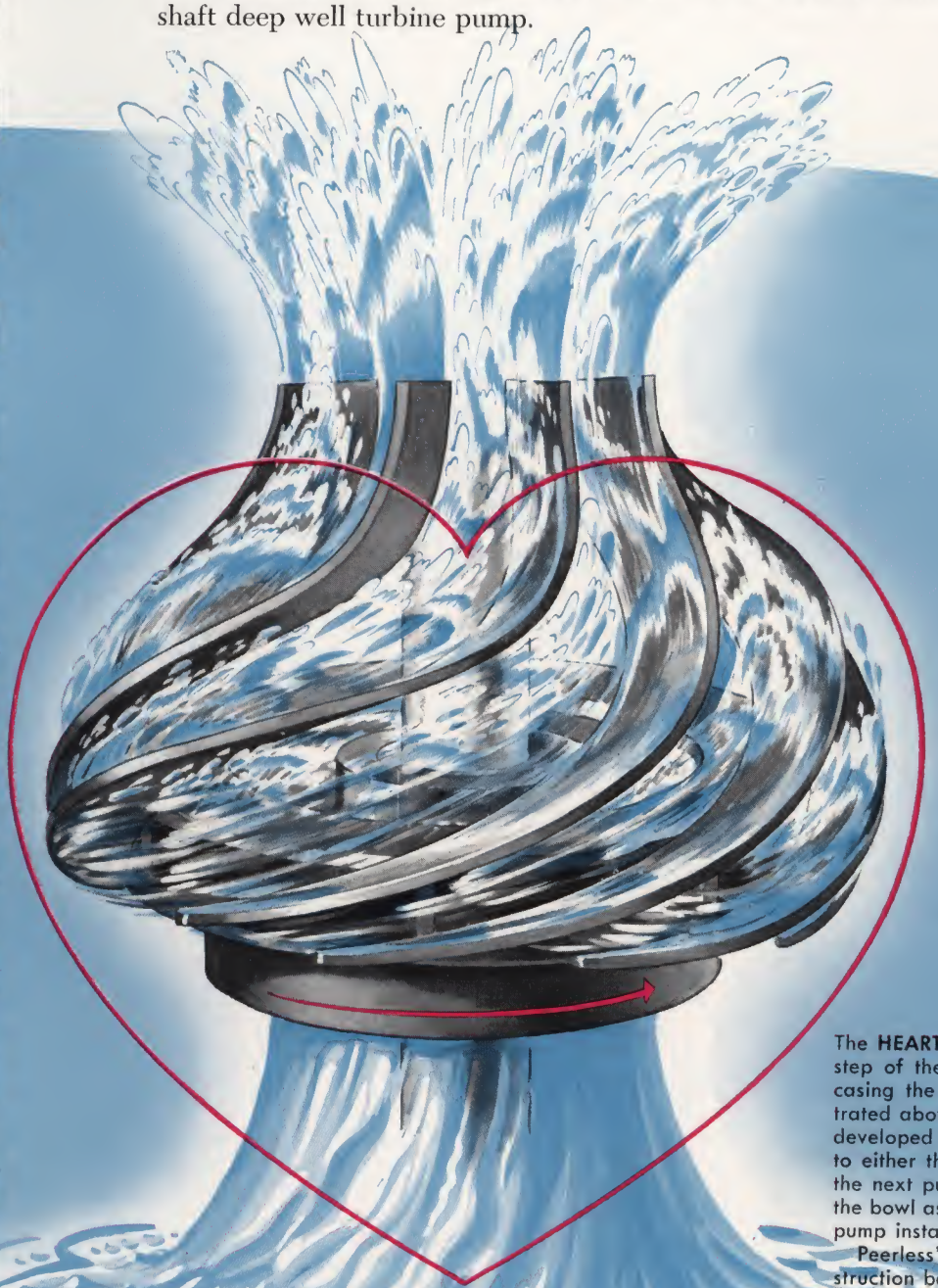
This third sequence in the lifting of water by centrifugal force is illustrated at the right. The impeller has been encased in a bowl confining the actual movement of the water, much the same as a mixer confines batter in a mixing bowl. More liquid rushes into the low pressure area created by liquid being forced to outside.





away from the center of the impeller, a low pressure area is created and more liquid flows in. Consequently there is a constant flow through the impeller and a continuous pumping action results. The pressure developed depends on the speed and diameter of the impeller. Because the pressure developed by one impeller in one housing or bowl (called a stage) in most cases is not sufficient to lift water to the surface from a deep well, pumps are built with several impellers and housings or bowl units mounted one above the other. These are called multi-stage pumps. In a multi-stage pump the total pressure developed is the sum of the pressures developed by the individual stages. In the photographs and drawings below this action is pictorially simplified to show the principle of centrifugal water lifting as performed by a vertical rotative shaft deep well turbine pump.





The **HEART OF A PUMP IS ITS IMPELLER.** In the final step of the pumping action, the bowl or housing encasing the impeller is contoured with vanes, as illustrated above at the left, to direct the centrifugal force developed by the impeller inward (as well as upward) to either the discharge through the column pipe or to the next pump bowl above it. The relative position of the bowl assemblies is shown in the sectional schematic pump installation photographed above at the right.

Peerless' scientific impeller and bowl design and construction based on exhaustive study and research contribute greatly to both pump life and pump efficiency.

THE PEERLESS OIL-LUBRICATED TURBINE PUMP

Peerless deep well turbine pumps are available in two types, oil-lubricated and water-lubricated. These designations refer to the methods employed to lubricate the bearings which guide the vertical rotating shaft within the column pipe. The selection of oil lubrication or water lubrication is optional. Each type has special advantages.

The design features of both types of lubrication are indicated in the sectional drawings.

In the oil-lubricated type, shown on the left, the shafting is enclosed in an extra-heavy tubing extending the full length of the pump column. Closely spaced bronze guide bearings also serve as tubing couplings. Oil introduced into the top of the tubing furnishes positive oil-lubrication to the line shaft bearings. In the pump on the right, the water-lubricated type, the line shaft is not enclosed but is supported by rubber guide bearings. The water being pumped acts as the lubricant for the line shaft bearings.

The provision for both types of lubrication in Peerless deep well pumps is based on demands by certain users for a water supply that is absolutely free from any oil. Further, certain regulatory bodies feel that there is a remote chance that oil used in oil-lubricated line shaft construction pumps might contaminate the water if it escapes from the pump into the water supply. Hence, Peerless engineers developed the open line shaft pump to provide a pump so designed that no oil is used below the surface of the ground. In normal usage there are advocates of both the oil-lubricated and the water-lubricated types of pump construction. Peerless offers both types and will make definite recommendations as to the proper selection of oil or water-lubricated construction for each individual application.

In the oil-lubricated type, the shaft enclosing tube is fabricated of extra heavy tube with the ends of each length of tubing faced in a lathe to insure perfect alignment and water-tight joints. It is held straight within the column pipe by a tubing tension nut in the pump head.

An oil reservoir with sufficient capacity for ten days pump operation* supplies lubricant to the bronze shaft bearings; it is located in the discharge casting. An adjustable automatic drip-feed lubricator feeds a constant and pre-determined amount of oil into the tube and thence to the shaft bearings. This positive means of oil-lubrication with the line shaft spinning within the oil enclosing tube creates a mist of oil to guarantee perfect lubrication of bearings.

* In normal settings and service.

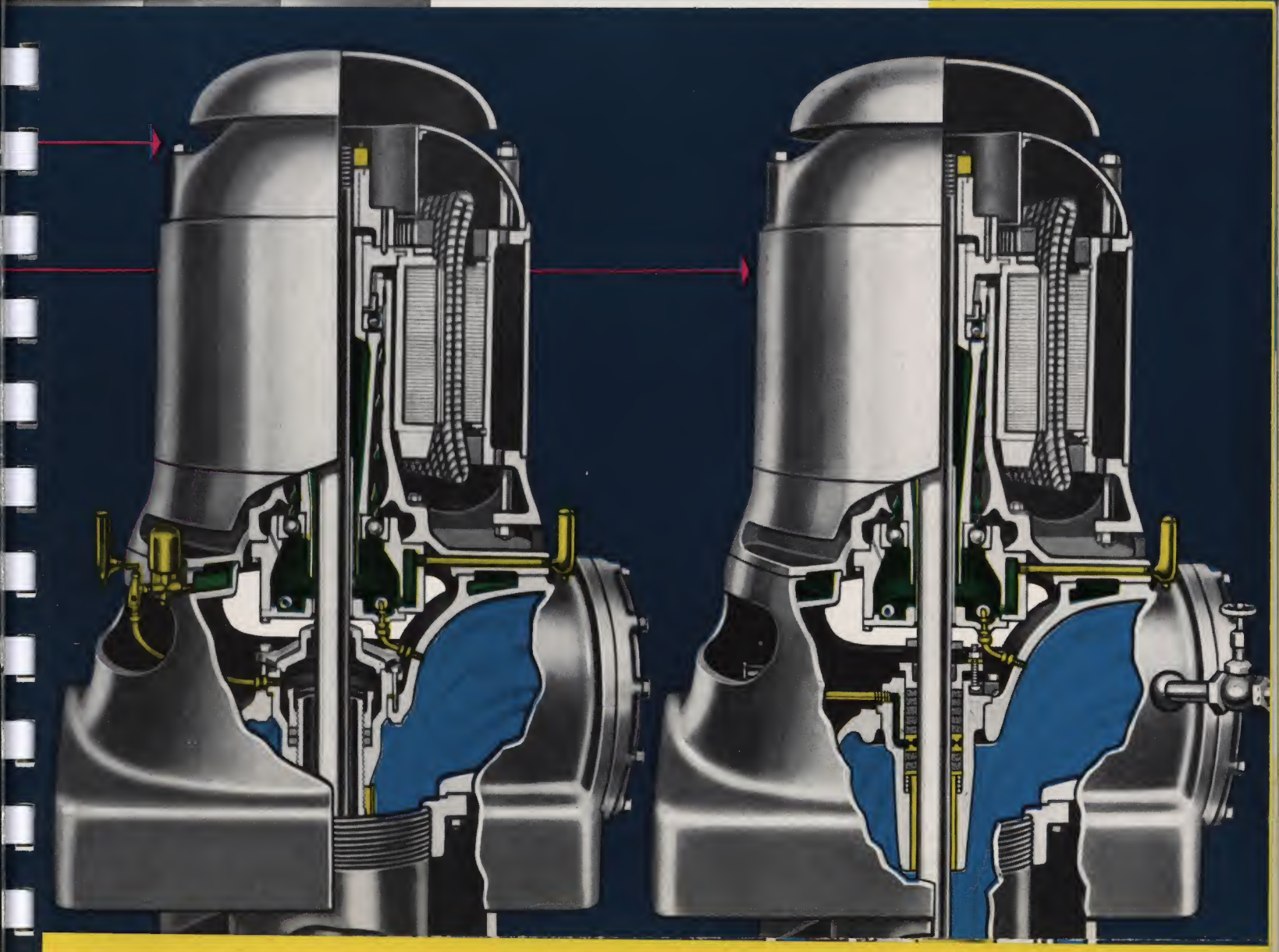
THE PEERLESS WATER-LUBRICATED TURBINE PUMP

In the water-lubricated type, lubrication of shaft bearings is accomplished by the water being pumped. The bearings in the water-lubricated pump are of fluted cutless rubber, held firmly in bronze spiders. A patented monel sleeve is swaged onto each line shaft at the point of bearing contact and plated with hard chrome. Hence, the bearing surfaces are smooth hard chrome and wet rubber, presenting an almost frictionless contact. The rubber is most satisfactorily lubricated by water and any frictional heat is dissipated by the continuous flow of low temperature water. Because the bearings are immersed in the flowing water, the flutings in the extra-long cutless rubber bearings serve as escape routes for any particles of sand being carried in the water supply. The hard chrome plating on the monel sleeve prevents scoring of the bearing surface by any sand passing through.

These are the optional methods of lubrication of shaft bearings on Peerless deep well turbine pumps. The choice of lubrication, whether water or oil, is one that the pump user can make at his own discretion.

As stated above, Peerless field engineers will make recommendations, based upon the individual application, taking into consideration the purpose for which the well water is being used, the geographical location, the chemical content of the water, depth of well, pumping level, seasonal fluctuations, and other pertinent factors.

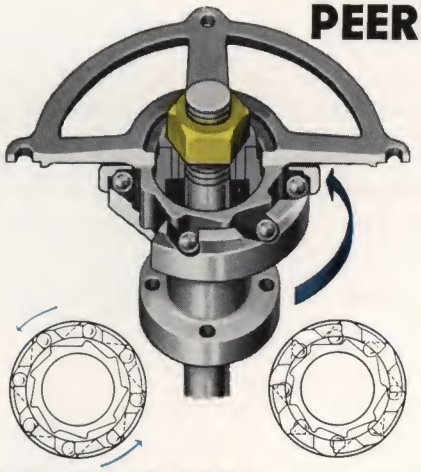
A close study of the two Peerless designs on the opposite page will reveal other points of engineering excellence such as the method of cooling the lubricant in the pump head, the ingenious packing arrangement, the unique bearing contact; these are found only in Peerless deep well turbine pumps.



Look beneath the surface for top flight quality underground

PEERLESS LINE SHAFT AND COLUMN

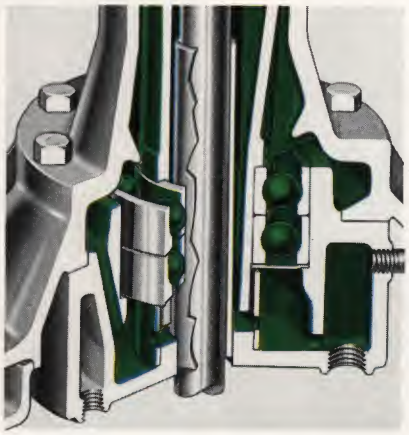




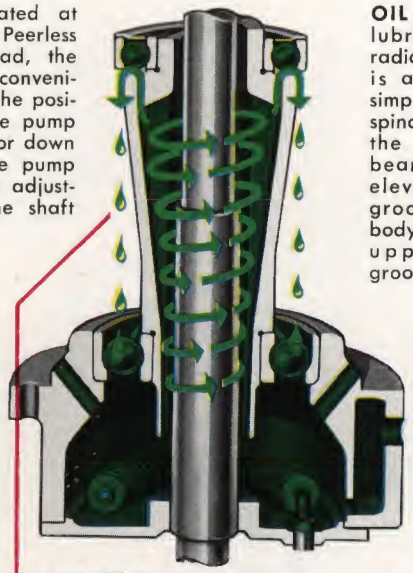
NON-REVERSE RATCHET. A positive ball and tooth ratchet mechanism may be furnished to instantly prevent reverse pump rotation. When motor is running forward, balls in rotating cage are thrown up and to the outside due to centrifugal force. When rotation ceases, gravity causes one of the balls to drop and engage a stop tooth in the ratchet member, affording positive and instant non-reversing control.

In keeping with Peerless precision methods, only turned-ground-and-polished steel line shafting of high tensile strength and uniform quality is used. In order to meet the rigid standards of Peerless for straightness and exact diameter of shafting, the line shaft is mill-run to Peerless' specifications. All shaft threads are accurately machined to hardened gages. Column pipe is also mill-run to exacting Peerless standards to assure uniformly high quality. All column pipe is threaded with faced ends and reduced taper so that when column ends butt against each other, or the bearing spider, the threads are tight. All operations in the machining of both shafting and column are done in Peerless' own factories; only the raw shafting and column stock is made outside of Peerless' own manufacturing facilities. Complete laboratory analyses and rigid inspection of each mill shipment assure Peerless that its standards of perfection have been met or exceeded. A final check for shaft straightness is made just prior to crating for shipment to the job.

ADJUSTING NUT. Located at the top of the motor in Peerless hollowshaft Moturbo head, the adjusting nut provides a convenient means for adjusting the position of the impellers. The pump shaft is free to move up or down in the hollowshaft of the pump motor to provide precise adjustment. Once adjusted, the shaft is locked in position.



THRUST BEARING. Illustrated above is the angular contact, heavy-duty, DUPLEX type bearing, utilized for extra-thrust loads. These bearings are used for additional safety factor, when pumping from extreme depths. The thrust bearing is located at the lowermost part of the pump motor to obtain maximum rigidity and to house it at the coolest part of the motor. Heavy-duty construction provides an ample safety factor for all loads within its rating. Single row bearing is standard construction.



OIL PUMP. Positive oil lubrication of both the radial and thrust bearings is accomplished by a simple oil pump. As the spindle rotates, the oil in the reservoir below the bearings is centrifugally elevated up the inclined grooves in the spindle body. Small holes at the upper end of these grooves meter oil to the radial bearing, the returning oil from the radial bearing drips down into the thrust bearing and from there back into the reservoir.

SHAFTING. The advantages of the hollowshaft type construction which permits lateral adjustment of the impellers by use of the top shaft nut are clearly shown in the illustration.

OIL SYSTEM: Oil is added to reservoir through the oil level gage, located outside of the discharge casting. The level gage contains a dip stick to show level of oil in reservoir.

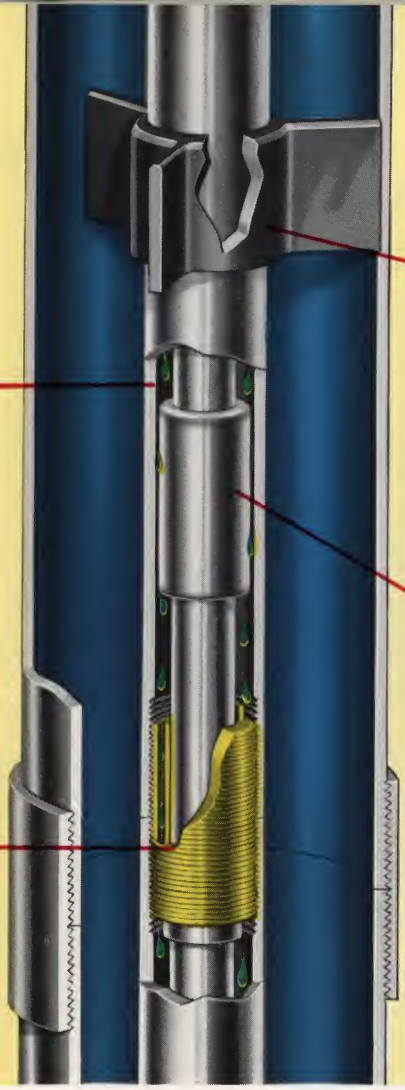
OIL COOLING: To cool the oil in the oil reservoir, water from the discharge elbow is forced through inner cooling tube positioned in the oil reservoir. The movement of water is continuous and positive.

OIL-LUBRICATED COLUMN CONSTRUCTION. Several important features distinguish the construction of oil- and water-lubricated type pumps. The major difference is the enclosing of the shafting in a tube, in the oil-lubricated type shown at the right. This tube provides a positive means of lubricating all bearings throughout the length of the column. The water-lubricated type (shown below) has no enclosing tube and uses the well's own water to lubricate the bearings.

OIL ENCLOSING TUBE. This tube is fabricated of extra-heavy pipe with the ends of each tube faced in a lathe to insure perfect alignment and watertight joints. It is suspended from the tubing tension nut in the pump discharge casting. Inside this tube the pump shaft spins in a continual mist of oil carefully controlled by a positive drip feed regulator. The oil reservoir, located in the discharge casting is independent of that which lubricates the thrust and radial bearings.

BEARINGS. Peerless shaft bearings are made of special composition bronze, accurately machined to close tolerances. A spiral groove is machined in the bearing to facilitate positive and uniform flow of oil over the entire bearing surface. In addition, a longitudinal hole in the wall of each bearing bypasses excess oil to the next bearing below and provides a vent which prevents air locking so that the oil can flow readily from bearing to bearing.







STABILIZING SPIDER. Tube stabilizing spiders press-fitted over the shaft enclosing tube at intervals, stabilize the tube within the column pipe.



COUPLINGS. Peerless shaft couplings are machined from solid stock for utmost strength and accuracy. This high degree of accuracy is necessary to insure a perfect butt fit of the shaft ends in the center of the coupling. A relief hole is drilled in the center of the coupling wall to allow escape of air and oil as the two shaft ends butt tightly together.

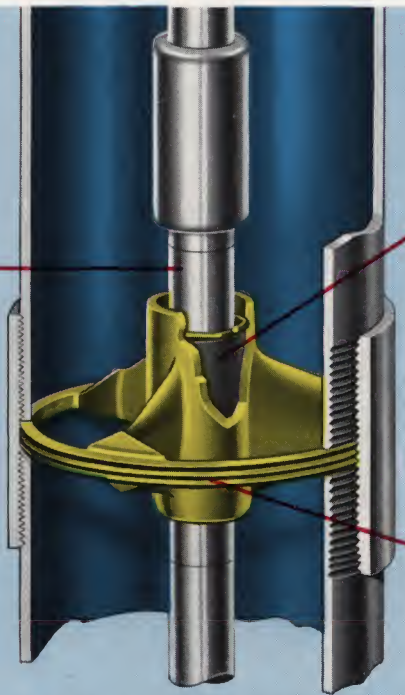
COLUMN PIPE FLUSH JOINTS. Each length of column pipe butts end to end with the next length to form flush inside joints, assuring a smooth water passage and eliminating any place tor sand or foreign particles to lodge. The column pipe couplings firmly lock butt ends together.

WATER-LUBRICATED COLUMN CONSTRUCTION. The water-lubricated type of construction (at right) differs from the oil-lubricated type of construction (above) in that the line shaft bearings are lubricated by the well's own water rather than by oil. The bearing construction of the water-lubricated pump is entirely different from that of the oil-lubricated pump as is shown in the detailed section.

CHROMED ALLOY SHAFT SLEEVES. Since in the water-lubricated type of pump the bearings are rubber, the shaft must present the smoothest and hardest surface possible at the bearing point. To accomplish this, Peerless presses an alloy sleeve into a recess on the shaft. By a special process this sleeve is made to fit rigidly on to the shaft and forms a smooth continuous surface of the same diameter as the shaft. This alloy insert is then plated with a hard chrome plate overlay with a Brinnell hardness of 1000 minimum, greatly increasing bearing life.

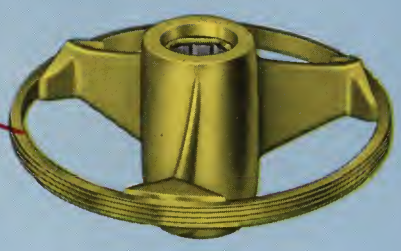
LINESHAFT. In the water-lubricated construction the lineshaft for its full length is protected with a smooth, hard synthetic enamel coating.







LINESHAFT BEARINGS. Long, fluted cutless rubber bearings, the first one of which is five feet below the pump head, are spaced at ten-foot intervals down to the lowermost shaft bearing, which is five feet above the bowl unit. The bearings are rigidly held in bronze spiders as shown.



BEARING RETAINER SPIDERS. Peerless spiders are heavy, one-piece solid bronze castings. The bearing retainer body is connected by three equally spaced arms to an outer ring which is accurately threaded to engage the threads in the column pipe coupling. The outer ring thickness is accurately machined so that the ends of the column pipe butt against the ring at the same instant that the threads tighten in the pipe coupling. The inside of the ring is the same diameter as the pipe, allowing a smooth non-turbulent flow of water up the pipe and minimizing water friction losses.

PEERLESS BOWL CONSTRUCTION

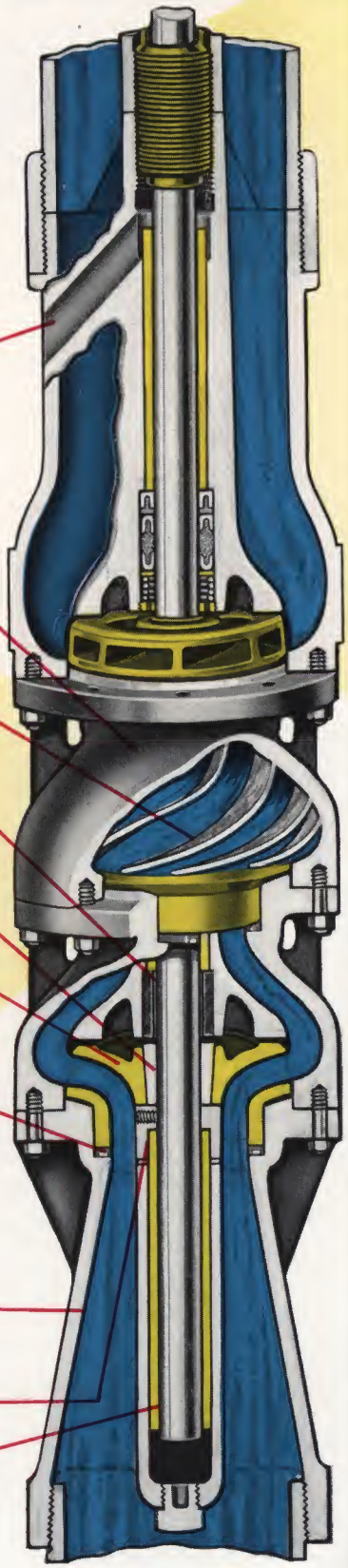
(OIL AND WATER LUBRICATION)

The heart of a turbine pump is the pump bowl and impeller, for here is the initiator and maintainer of a pump's efficiency. All Peerless intermediate bowl bearings are water lubricated, so the design of Peerless bowls is identical in both oil and water-lubricated type pump construction. Each complete pump bowl assembly is called a "stage" and the number of bowl assemblies required to raise water from a certain setting to the surface are referred to as stages, so that a pump with 15 bowls is called a 15-stage pump. A pump stage consists essentially of a bowl and impeller, dual bearings, impeller lock and a lateral seal ring. On these two pages are detailed many of the important construction features of Peerless bowl assemblies that contribute to the excellent performance and over-all efficiency ratings that characterize Peerless vertical turbine pumps.

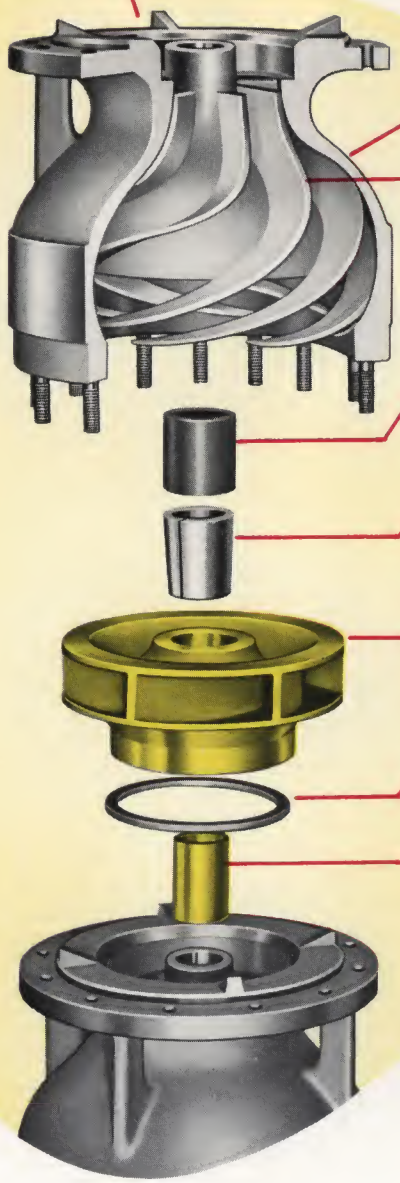
Although the sectional drawing at the right is an oil lubricated pump, the bowl section detailed at the left is the same in both oil lubricated and water lubricated pumps. Each intermediate bowl, below the top bowl, is water lubricated. Exploded views on the opposite page show the difference in construction between the oil lubricated top bowl bearings and the water lubricated top bowl bearing.







Stilling elements prevent rotary circulation.



BY-PASS (OIL LUBRICATED TYPE ONLY). Water passing through manifold seal is by-passed to well before reaching bearing above.

BOWLS. All bowls are machined from seasoned, close-grain iron castings. Bowls can be cast of special metals when required.

VANES. Vanes are cast integrally in the bowl assuring great mechanical strength and smooth water passages.

BOWL BEARINGS. Peerless utilizes both rubber and bronze bearings to get the benefit of both types of construction. This is the rubber bearing.

TAPERED IMPELLER LOCK. Each impeller is fastened securely on the shaft by a split-tapered steel impeller lock bushing.

IMPELLER. Enclosed type, cast iron or cast bronze, hand-finished impellers are standard in Peerless bowl construction. Available also in other types of metals and alloys.

SEAL RING. Each bowl is provided with a resilient, cutless rubber seal with copper core insert which is inserted below the impeller skirt.

BOWL BEARINGS. Peerless utilizes both rubber and bronze bearings to get benefits of both types of construction. This is the bronze bearing.

SUCTION MANIFOLD. The suction manifold is identical in both oil and water lubricated pump types.

SAND COLLAR. Suction manifold sand collar prevents passage of sand into bowl above.

BRONZE SUCTION MANIFOLD BEARING. Extra long bearing stabilizes shaft; permanently grease packed.



LOWER SHAFT BEARING



BRONZE TOP BOWL BUSHING

TOP MANIFOLD SEAL
Consisting of:
U-Leather Seal



Packing Separator



U-Leather Seal



U-Leather Seal

Washer

Spring



Spring Follower

(Mastic Packing not shown)



TOP BOWL BEARINGS

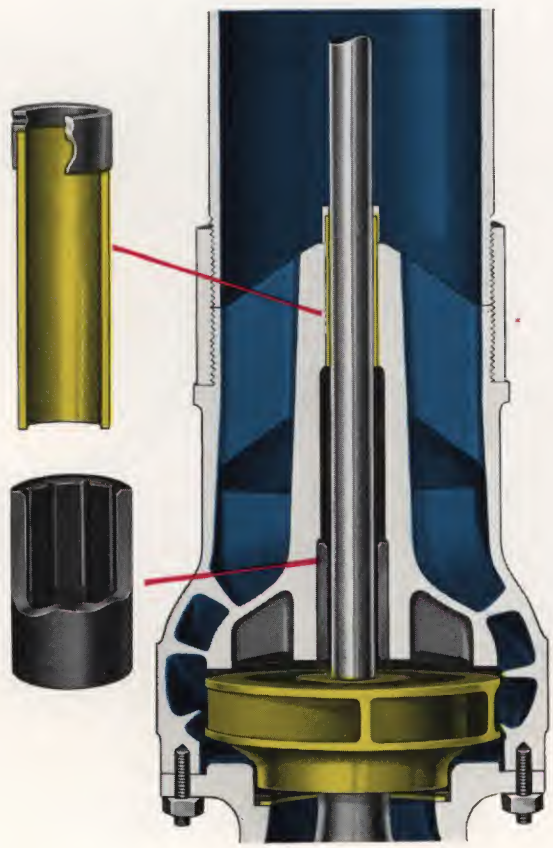
Although the intermediate bowls are identical in both the oil lubricated and water lubricated types of Peerless turbine pumps, the top bowl bearings of oil lubricated pump and the water lubricated pump differ in construction. Details of this difference in construction are shown on this page with the oil lubricated top bowl construction described and illustrated at the left and the water lubricated top bowl construction described and illustrated at the right. The essential difference between the two is the use of a top bowl seal in the oil lubricated construction.

← OIL LUBRICATED TOP BOWL BEARING

The main bearing of the top bowl on the oil lubricated pump utilizes a top bowl seal to prevent passage of water from the bowl into the shaft bearings, enclosed in an oil enclosing tube above for the full length of the pump. Should some water pass through the seal, it is by-passed back into the well through a by-pass located directly above the seal: See Page 15.

WATER LUBRICATED → TOP BOWL BEARING

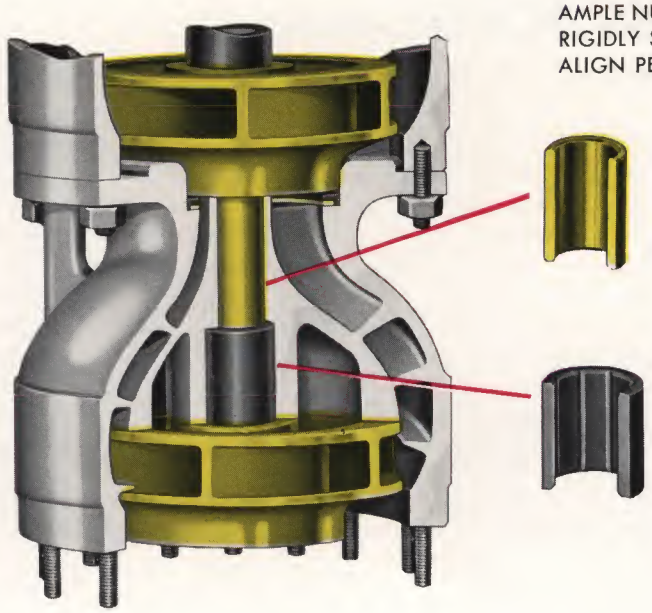
The top bowl bearing on the water lubricated pump provides the double bearing feature, using a fluted, cutless rubber bearing just below a bronze bearing. Water re-circulation is restricted through use of a bronze sand collar on top of the bronze bearing as shown in the illustration above.



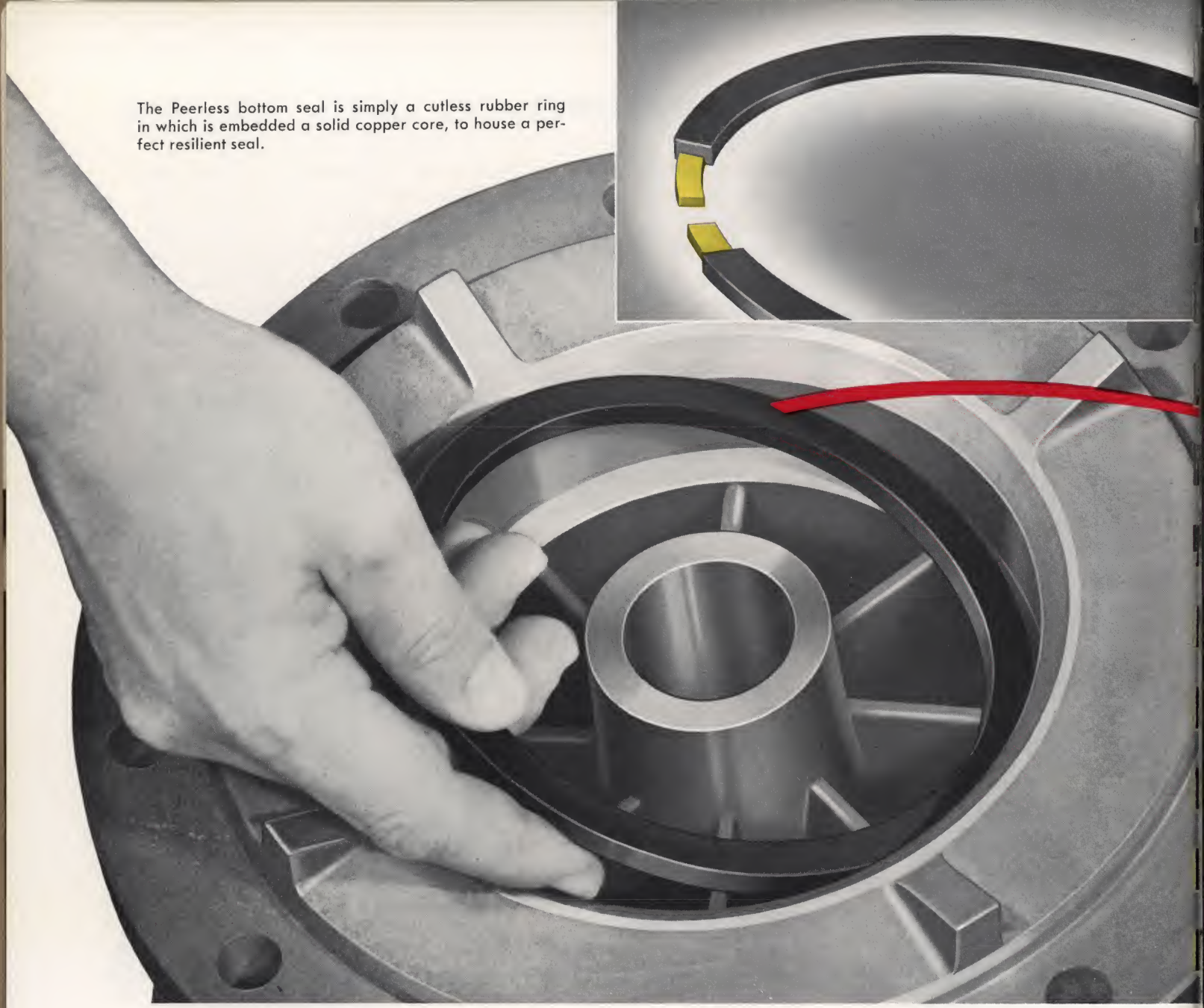
DOUBLE BOWL BEARINGS

Some pump designers advocate rubber bearings for pump bowls, others recommend bronze. Peerless recognizes and uses the merits of both. As illustrated at the right, cutless rubber forms the lower portion of the dual bearing, lending its superior characteristics in water containing abrasives. But, since it is desirable to maintain the smallest possible hub diameter in the bowl, immediately adjacent to the entrance of the impeller, and the thickness of the rubber precludes its advantageous use at this point, Peerless places a renewable bronze bearing above the rubber bearing.

This method of construction is superior to other methods of bowl bearing construction because **the bowl bearings are perfectly water lubricated and additional support is obtained for the impeller shaft throughout the entire length of the bowl, thus virtually doubling the life of the shaft.**



AMPLE NUMBER OF STUDS RIGIDLY SECURE AND ALIGN PEERLESS BOWLS



The Peerless bottom seal is simply a cutless rubber ring in which is embedded a solid copper core, to house a perfect resilient seal.

PEERLESS DOUBLE-SEAL

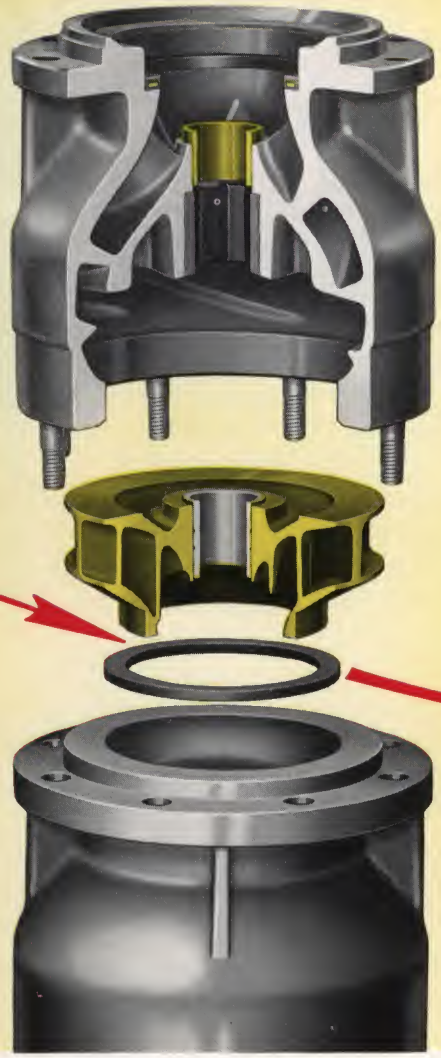
Minimizes Loss from Sand-cutting — Assures Longer Life

Wherever sand is found to be present, it is always a problem from deep wells. With open and semi-open impellers the vanes wear away, necessitating expensive repairs. In the enclosed impeller as used by Peerless, the fit between the impeller skirt and the bowl ring was the most vulnerable point. After years of tests and experimentation, Peerless perfected the Double-Seal which overcomes water loss as a result of sand-cutting.

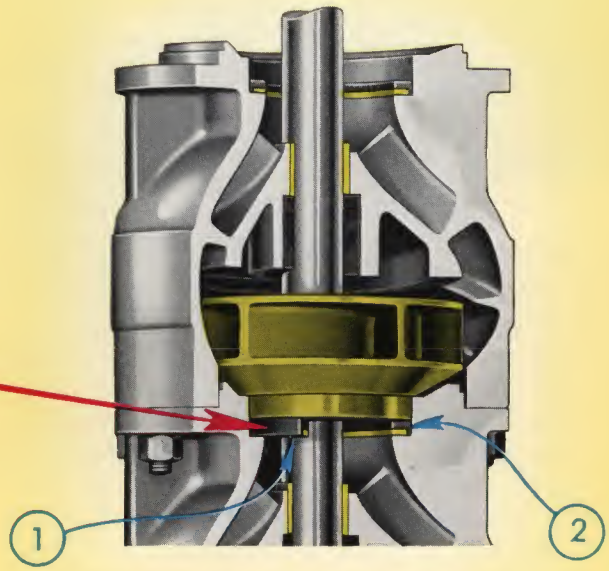
In the conventional design of enclosed impeller, a water seal is obtained by providing a close-running fit between the side of the impeller skirt and the stationary bowl. This is satisfactory when the pump is new, but if the underground water contains sand and sediment, then the abrasive action eventually wears away the impeller skirt and the seal is lost.

Peerless has developed a water seal that brings pump users a new era in maintained pump performance. Peerless Double-Sealed pump bowls are an exclusive Peerless feature, fully protected by patent.

Like many improvements, the Peerless Double-Seal is very simple. It consists of a resilient ring fitted in the bowl housing just below the skirt of the impeller. From the surface of the ground the clearance between the impeller and the bottom seal ring can be accurately adjusted to insure a perfect water seal, and is easily re-set to compensate for wear.



The simplicity of this design and application of Peerless Double-Seal is apparent in these drawings, showing both an exploded view and an assembled view of its position and placement in the pump bowl.



The patented Double-Seal, as illustrated at (1), is mounted below the impeller skirt. So, regardless of any wear which might take place on the side of the impeller skirt, as illustrated at (2), the sealing efficiency remains unimpaired. Because sand-cutting action reduces pump capacity and necessitates eventual repairs, the effectiveness of this Double-Seal is apparent. This is a patented Peerless feature that contributes longer life and maintains the original capacity and efficiency of the pump.

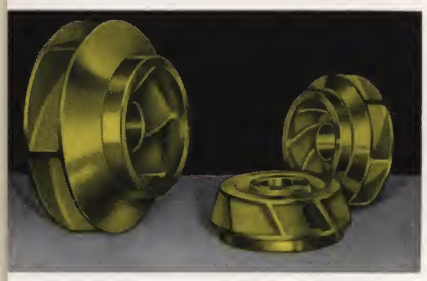
Early investigation showed that metal-to-metal contact at these points, due to high peripheral speed and the large diameters, caused wear at such a rate that it was impractical to attempt to seal without modification of either the rotating or stationary elements. Even the hardest commercially available materials, such as Stellite or Nitralloy, having Brinnell hardness close to the hardness of sand, would be rapidly cut by the abrasives. A resilient surface was found necessary, and finally, after continued experimental work a compound was developed of a very soft nature, having sufficient resilience to allow the abrasives to roll without embedding themselves in its surface beneath the metal impeller, irrespective of its operating speed. Although the resilient cutless ring is itself composed of a very flexible material, it has a solid copper core embedded in its center to give it stiffness and proper strength for pressing into the recess of the bowl. To appreciate the advantages of this resilient cutless seal, it is only necessary to point out that sand and gravel pumps are now being built with complete rubber protection because cutless rubber most satisfactorily withstands sand abrasion.

In addition to providing this new resilient bottom seal, Peerless engineers have continued the use of the customary side seal; hence the term Double-Seal. The chief value of the side seal is that during the original operation of the pump, particularly in a new well, critical end adjustment of the impellers is unnecessary, with the result that the impellers can be set midway between the end freedom provided, with definite assurance that the pump will not have to be stopped for correction of a possible maladjustment during the development of a well. This practice otherwise could be very dangerous as oft-times wells are totally sanded up or ruined as the result of stopping a pump during the process of development. If the abrasives handled in the water during development are sufficient to seriously abrade the side seal and cause appreciable losses in efficiency, it is only necessary to make a simple adjustment of the drive shaft with the top shaft nut to bring the bottom seal into effect and minimize the loss in capacity and efficiency resulting from the worn side fit.



PEERLESS ENCLOSED IMPELLERS

Precision-Made to Highest Standards



The most commonly used impeller types are the fully enclosed or the semi-open design. Peerless uses the former type exclusively in its deep well turbine pump design because experience proves that it offers more advantages.

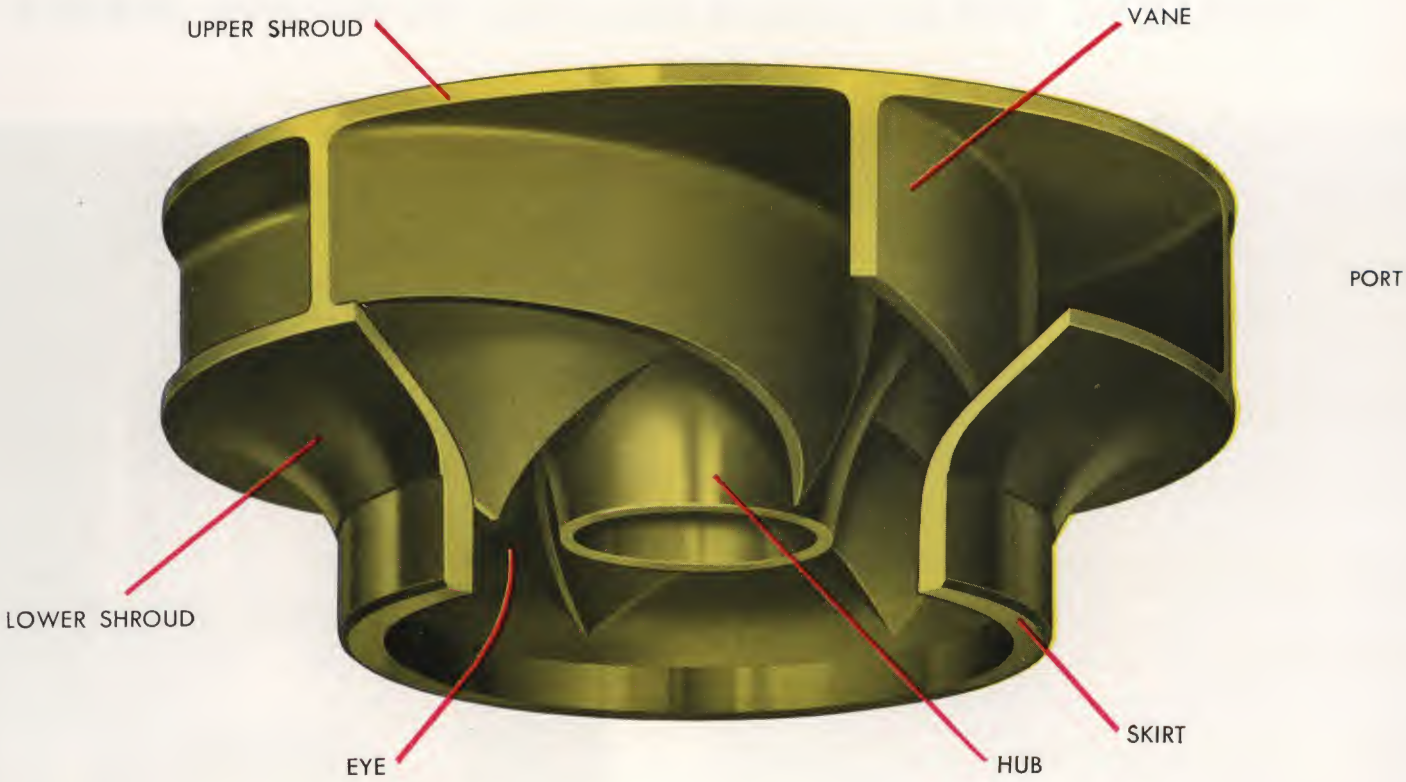
Whichever type is used, it is necessary to maintain a close-running fit between impeller and bowl case to prevent recirculation. With the enclosed impeller the close-operating bottom fit can be easily maintained without wearing on the vane edges and reducing port width. Reduction of port width means a reduction in pump capacity, and corresponding loss in efficiency.

The enclosed double seal impeller used by Peerless permits lateral adjustment, and due to the fact the seal is made at the impeller skirt over a relatively narrow surface, there is no variation in the amount of wear. Obviously, if an attempt is made to create a seal by close-running fit where the surface speed varies widely between the inner diameter and the outer diameter of the seal, the uneven wear which takes place prevents the accurate lateral adjustment necessary to sustain efficiency.

Because of the patented Double-Seal feature, described previously, the Peerless impeller design overcomes the former objection of inability to make surface adjustments. The skirt of the impeller provides a close-running fit against the resilient seal ring as well as against the side of the bowl case. Where extreme sand conditions prevail, Peerless may eliminate the impeller side seal by machining the bowl for greater clearance and retaining the lateral seal ring to create a bottom seal only, thereby eliminating any possibility of sand locking.

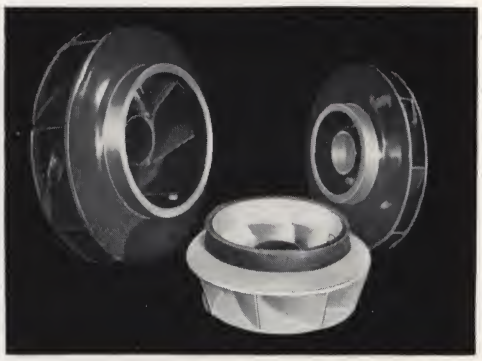
Territories known to have water conditions requiring special impeller materials are individually considered in selection of the impeller material. The most common materials found applicable to the average water condition, consist of bronze, close-grained gray iron, high nickel content, such as Ni-Resist, and porcelain enameled iron.

All Peerless impellers are made from accurate metal patterns to insure uniformity in



castings and performance. All vanes and guide passages are hand-finished to insure minimum loss. Balancing is done on each impeller in the last step in manufacture. As the bowl unit is assembled, the impellers are again checked for balance in the assembly.

Numerous characteristics, such as low head-high capacity and low capacity-high head, impellers are designed for various pumping services. Hundreds of impeller designs to meet diversified requirements are available, although the standard characteristics of Peerless impellers include such items as non-overloading type impellers (flat horsepower curve throughout their normal range of capacity); steep head-capacity curve in order to obtain a minimum variation in the amount of water pumped with the wide variations in head; peak efficiencies as high as practicable, still maintaining a broad, high-efficiency range.



PEERLESS TAPER LOCK: Each impeller is securely fastened to the stainless steel impeller shaft by means of a special split-tapered impeller lock. The pressure with which the lock is applied inside of the impeller hub is so great that there is absolutely no possibility of the impeller loosening from the shaft; however, a very simple tool makes assembly and disassembly an easy matter.

Every impeller is accurately set in proper relation to the adjacent pump bowl seal ring and minute variations in the bowl or impeller dimensions will in no way affect the accuracy with which the impellers are adjusted to the seal.

PORCELAIN PUMP BOWLS AND IMPELLERS: Peerless furnishes porcelain lined impellers and bowls to meet conditions which are not satisfactorily met by either bronze or iron impellers. In most cases porcelain impellers only are furnished, since the rotating impeller is more subject to cutting action than the stationary bowls.

The improvement in pump performance as a result of reduction in skin friction by applying a continuous porcelain coat to the impeller, allows considerable saving in operating costs and minimizes abrasive wear. The Peerless process prevents loosening or scaling of the porcelain.

PEERLESS DIRECT-CONNECTED ELECTRIC DRIVE

THE PEERLESS MOTURBO



Peerless-designed weatherproof vertical hollowshaft motor

The all-important design of the motor and its weatherproof housing, for the Moturbo electric, direct-connected, hollowshaft, vertical pump drive combines every advantage of ventilation and protection against the elements, with many mechanical design features in motor construction to make possible Moturbo's remarkable driving efficiency.

This operating efficiency is from ½ to 2 points higher than similar equipment, according to accurate tests by leading motor manufacturers. The Peerless Moturbo is furnished in sizes from 10 to 500 hp, making available the widest range of horsepower for all deep well applications, regardless of lift. The advantages of the hollowshaft motor, a feature of Peerless vertical pump design, are found in the elimination of the old mechanically vulnerable flexible couplings, familiar in solid shaft construction. The hollowshaft motor, allowing easy lateral shaft adjustment, provides Peerless with a simple and convenient means of positioning the pump impellers. When equipped with a non-reversing ratchet motor spindle, the pump shaft connects with the motor through a non-reversing drive coupling, to provide protection against uncoupling of shafts upon reverse rotation of the motor.

The efficient ventilation of a pump motor has proved to be one of the most difficult and controversial designing problems the pump-motor engineer has been called upon to solve. Peerless engineers solved this so well that motor, windings and bearing reservoir are completely weatherproofed, to prevent the deteriorating effects of dust storms and other adverse weather conditions. The Peerless Moturbo requires no protective enclosure in the field.

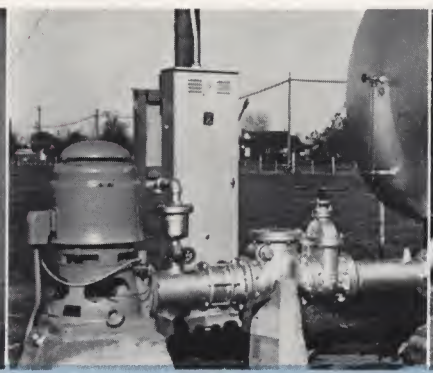
The Peerless thrust bearing is located at the lowermost part of the motor housing to obtain maximum rigidity and to house this bearing in the coolest part of the motor. Downdraft ventilation, found by Peerless to be far the most efficient, inducts the air at the top of the motor and expels it at the extreme base, with ample separation between cool intake and warm discharge air currents. Over-size air passages are located throughout the motor to obtain an abundance of ventilation for cool operation.

The compact Moturbo pump drive is rugged in design, with an extremely low center of gravity. Its design requires minimum space for maximum hp rating. Its symmetry in exterior design is pleasing and makes for a good-looking installation.

FOR DETAILS OF CONSTRUCTION OF THE MOTURBO HEAD, SEE BULLETIN B-141, AND PAGES 11 AND 14 OF B-127.









Indoors or out, big or small, the Peerless Moturbo is truly one of the most effective and efficient methods of driving vertical turbine pumps.

PEERLESS RIGHT-ANGLE GEAR DRIVE

THE PEERLESS GEARTURBO

The perfect application of horizontal power to a vertical rotative shaft

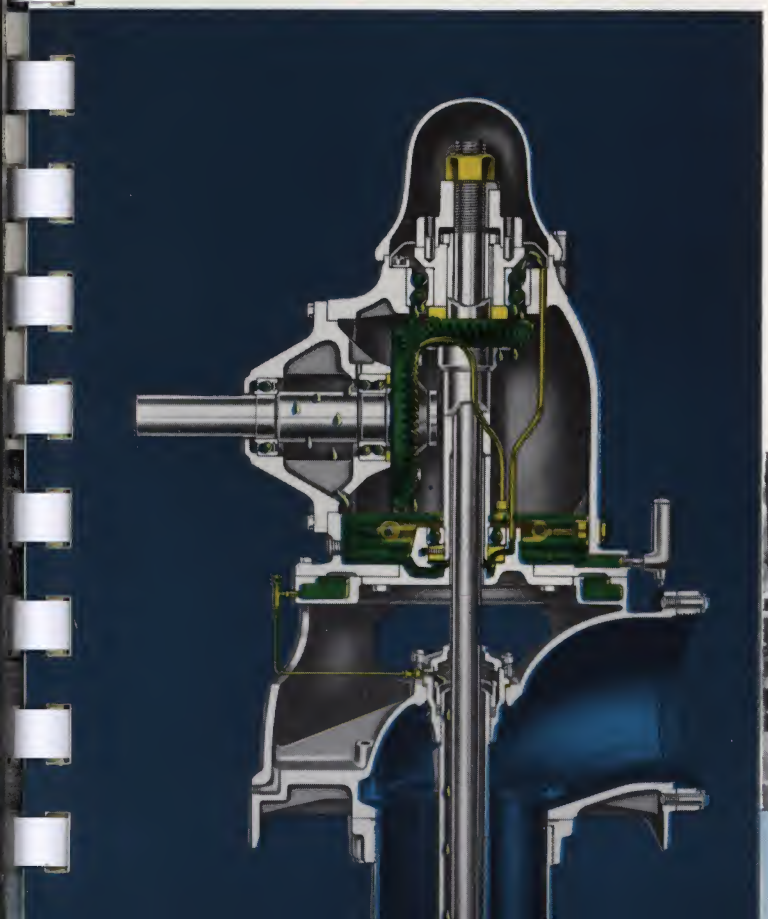
For locations where electricity is not available, or where natural gas, gasoline, diesel or steam turbine operation is more economical, the Peerless Gearturbo right angle drive squarely meets all user requirements. In its conversion of horizontal power to vertical drive, the Gearturbo approaches a new high in efficient power transmission.

The Peerless Gearturbo right angle pump drive head is designed with ample safety factor in all bearings, shafts and rotating parts. Enclosed in a heavy, compact, streamlined, semi-steel housing, it is adequately protected against the weather and all foreign elements, in any climatic conditions, requiring no protective enclosure.

Ratings of Gearturbo drives range up to 300 hp. Standard speed increasing ratios are: 1 to 1, 1 to 2, 2 to 3, 3 to 4, and 4 to 7. Decreasing ratio of 11 to 10 is also available in many sizes.

Spiral bevel gears used in Gearturbo are of nickel alloy steel, forged, heat treated, hardened and ground. They are lapped for specific operating tooth velocities.



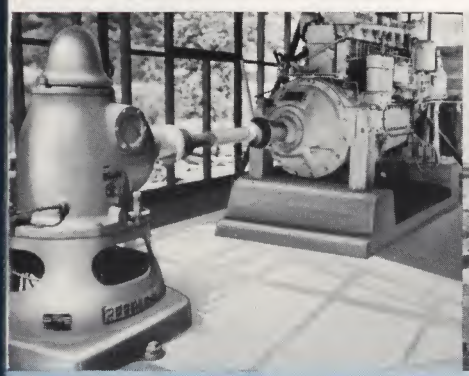


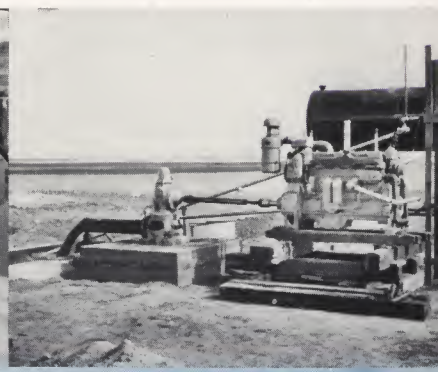
Bearings are of high quality, heavy-duty thrust and radial anti-friction type. Both vertical and horizontal shafts are supported on precision ball bearings to prevent damage to gear teeth and insure correct gear relationship under high torque loads and tough operating conditions.

Lubrication is assured by a simple oil pressure pump. Oil is continuously cooled by a finned tube through which cool well water circulates.

Pump shaft adjustment is made by means of an easily accessible positioning adjusting nut in the gear head.

PEERLESS GEARTURBO RIGHT ANGLE DRIVE PUMP HEADS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-140.





All types of stationary engines, gasoline, diesel or natural gas, can be applied as drivers for Peerless Gearturbo pump heads.

PEERLESS
COMBINATION DRIVES

MOTURBO-GEARTURBO

The Moturbo-Gearturbo combination drive unit offers an instant choice between electric and engine power, by means of the Peerless Moturbo drive and the Gearturbo right angle drive. With both of these power sources (electric or internal combustion), available in an installation, required space is minimized, yet the two types of motive power guarantee service in the event of failure of the electrical power for any reason.

It is possible to switch rapidly from electric to engine drive and vice versa. In either case the unit not in operation can be disconnected.

The Gearturbo unit is mounted directly on the discharge assembly and an additional pedestal or yoke, as shown in the illustration at the right, supports the electric Moturbo drive which is mounted above the Gearturbo right angle drive.

This type of combination pump head can be furnished as standard in sizes up to 150 hp. Larger sizes can be supplied upon special order.

The stationary engine or other motive power unit is directly connected to the Gearturbo drive by means of a flexible shaft, making a very compact installation.

For standby service and relief during peak loads, and where power breaks must not interrupt pump service, this Moturbo-Gearturbo combination is the ideal and most practical solution to the providing of uninterrupted service where the pumping cycle must be continuous.





An excellent example of the application of the Peerless combination Moturbo-Gearturbo pump head is shown at the left. Note particularly how this combination pump head utilizes an exceptionally small amount of floor space. Both indoor and outdoor installations are practicable. An outdoor installation requires no protective enclosure as both the electric and right angle gear drives are protected in weatherproof housings.

The City of Kerrville, Texas uses this Moturbo-Gearturbo combination drive head to insure its water supply at all times, through optional use of electric and engine drives.

PEERLESS BELT DRIVES

VEETURBO



The Peerless Veeturbo is usable with any type of stationary drive,—tractor, gas engine, steam turbine or diesel—by means of multiple "V" belts.

The efficiency of the modern, multiple "V" belt drive and its general acceptance in all types of power applications make it ideal for service in the pumping field, when electric power is not being used or is not available.

The Veeturbo drive incorporates many of the mechanical features of the Moturbo drive previously described, and the two are interchangeable—the Peerless discharge assembly being built to receive either type of drive. The Veeturbo pulley drive is available in sizes ranging up to 200 hp.

Proper diameter pulleys may be supplied to meet speed requirements of the driver.

The extreme simplicity of the Peerless Veeturbo commends it to many users. The drive embodies the same excellence of design for which all Peerless pumps are noted. It is streamlined, compact, rugged and in fine balance.

V-belt drive affords the utmost in efficiency in pulley drives and the multiple belt drive permitted by the Peerless Veeturbo head provides maximum efficiency in transmission of power for this type drive.

BELTURBO DRIVE The Belturbo drive is one of the complete line of Peerless vertical pump drives. It is similar to the Veeturbo except it utilizes flat type pulley instead of a V-type.



VERTICAL SOLID SHAFT DRIVE This type of drive utilizes a solid shaft electric motor. Electric motor is flexible coupled to pump shaft. Peerless designates this type of drive as the Peerless Flexturbo.



STEAM TURBINE DRIVE Peerless discharge assemblies are available to receive the steam turbine as a means of vertical pump drive. The turbine drive shown in the view below is of popular standard manufacture.



PEERLESS DEEP WELL TURBINE PUMPS WITH SUBMERGED MOTOR DRIVE

TOP FLIGHT QUALITY — UNDERGROUND

The dependable operation of this modern submersible turbine pump is made possible, in part, by new scientific advances in submerged motor design by America's leading motor manufacturers, and, in part, from the improvements in metallurgy providing extra long life from all metal parts.

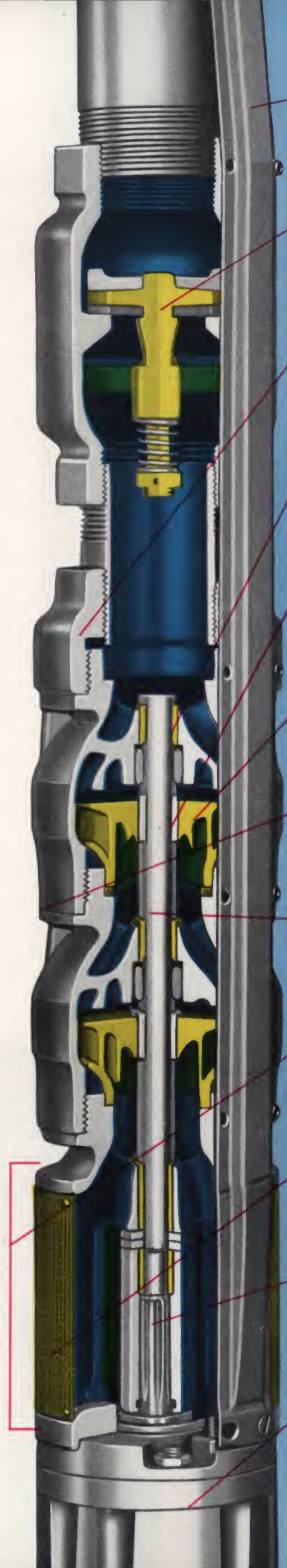
In the modern Peerless submersible pump a new, unitized Peerless discharge head is strongly constructed for extra rigidity and maximum safety of suspended parts and ease of handling of electrical power connections. In addition, high efficiency Peerless bowl and impeller units provide a most dependable low cost water supply from submerged motor pumps.

A wide selection of Peerless head-capacity ranges assures plenty of water from popular size deep wells and the user will find that Peerless offers favorable advantages in first cost in comparison with deep well lineshaft pumps of settings to 100 feet or more.

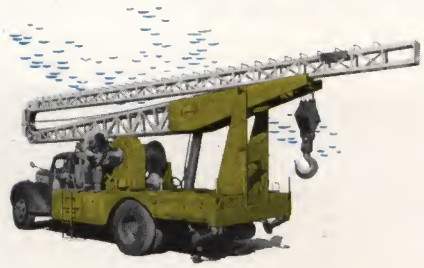


CHARACTERISTICS

HEADS	*Up to 500 feet*
CAPACITIES	*40 to 400 gpm*
MOTOR SIZES	*7½ hp; 10 hp; 15 hp 60 cycle, 3 phase, 3500 rpm*
FOR WELL SIZES	*6"-6⅝" and larger, inside diameter*



NEW LIFE FOR OLD PUMPS



A complete pump overhaul and rebowling job will often salvage a pump, at a measurable saving over the purchase of a new one. In times when costs are high, and complete replacements can be avoided in favor of partial replacement, real service to pump owners is provided if the replacement or repair is done efficiently and economically. The repair and replacement service of Peerless in the field offers a new chance for the old pump. "New life for old pumps" is more than a Peerless slogan,—it's a Peerless fact. It has been accomplished time and time again with truly remarkable results in both reduction in power costs and increased water output.

In the event of repair and replacement, Peerless often works out a schedule of as little as three days downtime from shutdown to fully restored pumping service.

Peerless facilities and stock of parts in the field insure rapid return of a "down" pump to service.

With this field and distributor service, strategically located by Peerless for maximum convenience to the greatest number of pump users, most pump operators have learned to have their equipment periodically inspected by Peerless field service engineers. By anticipating normal service factors, from indications which appear in the ratio of power used to water pumped, pump owners are able to plan a maintenance program that gives them the maximum of continuous, efficient service.



New life for old pumps in action. Here workmen in a Peerless field service shop reassemble an 18-stage deep well pump after a reconditioning and rebowling job to restore pump efficiency and water output.



RESTORE LOST EFFICIENCY WITH PEERLESS BOWLS

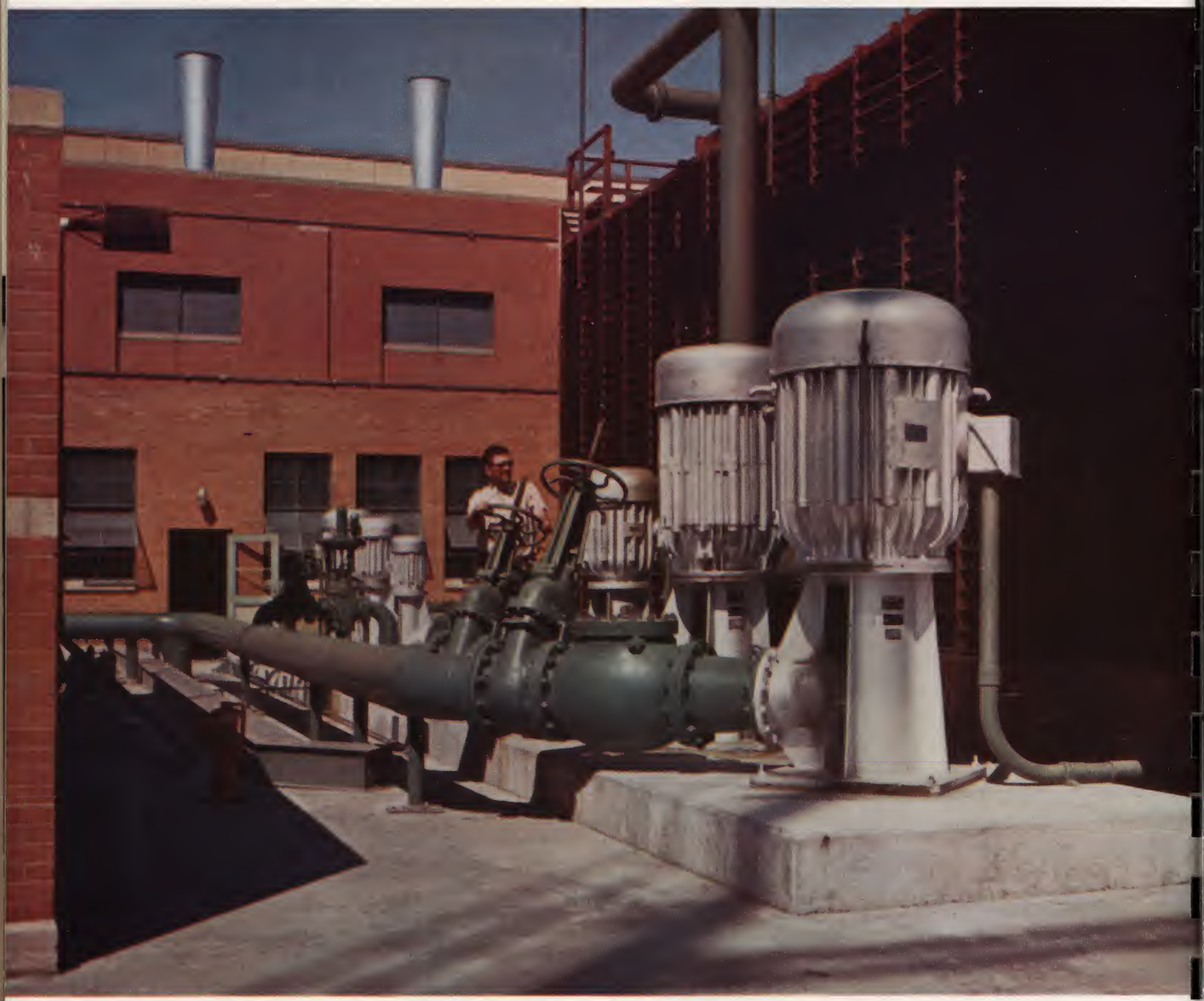
The replacing of worn-out bowl units on pumps of other makes by Peerless bowls becomes possible because of the practicability of interchanging standard pump parts, between various makes, usually with only minor adaptations. Many pump owners are aware that Peerless pump bowls out-perform those of other makes, and the demand for Peerless replacements has resulted in widespread field and distributor repair service to effect replacements with speed and high efficiency.

Regardless of the make of a deep well pump, men and machines in Peerless' own field and distributors' organizations can frequently make old pumps run like new.

The remarkable performance records that Peerless bowls have provided both as to durability and maintained efficiency, has made them first choice for rebowling service.

Mobile, hydraulic, pump pulling units of Peerless are equipped with portable derrick to quickly pull the "down" pump and rush it to experts, in the nearest Peerless pump repair and service center. In localities where Peerless does not have its own service facilities, we are well represented by able distributors who also have such equipment.

PEERLESS VERTICAL



MODERN VERTICAL DESIGN IS EXEMPLIFIED IN THESE PEERLESS INDUSTRIAL SERVICE PUMPS INSTALLED IN COOLING TOWER SERVICE.

INDUSTRIAL SERVICE PUMPS

APPLY PEERLESS INDUSTRIAL SERVICE PUMPS TO PUMPING FROM COOLING TOWER BASINS, TANKS, PITS AND SUMPS, RIVERS, LAKES, BAYS, PONDS, RESERVOIRS, CANALS AND OTHER SURFACE SOURCES.

CAPACITIES	*15 to 40,000 gpm*
HEADS	*Up to 1000 feet or more*
HP RANGE	*Up to 2500 hp*
DRIVES	*All types and combination of types*
ALWAYS PRIMED	



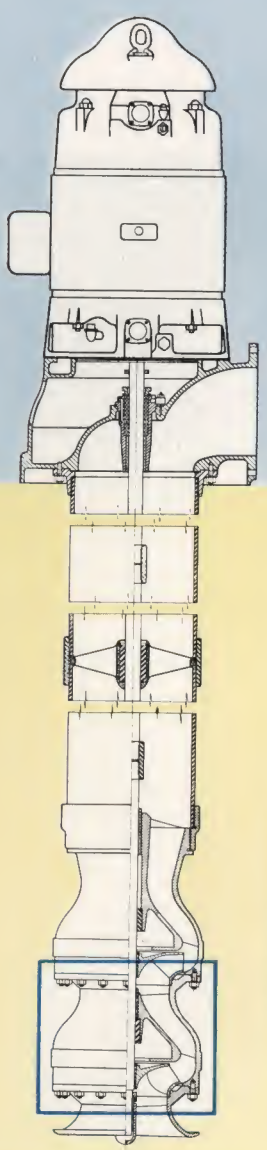
The Peerless vertical industrial service pump is designed and constructed for pumping in industrial and process services.

In recent years, Peerless engineers have accumulated and evaluated a vast amount of new technical information concerning the behavior and action of fluids being pumped from systems which involve short-setting pumps.

The design characteristics of the improved modern Peerless vertical close-coupled industrial service pump incorporate the results of these comprehensive studies to provide new standards of maintained efficiencies, and a new concept of versatile application in pumping liquids from short settings.

Of paramount importance to pump buyers are these features of the Peerless vertical close-coupled pump: the availability of 3 basic production designs for complete flexibility in application, the use of economical solid shaft motors, with the availability of hollowshaft electric motors if desired; the use of flanged type couplings on the pump column (with the availability of screwed column if desired); open line shaft construction (with availability of enclosed line shaft construction or oil lubrication, if required); bronze, Neoprene or other synthetic type composition bushings; L type wear rings and lateral seal rings on pump bowls; and the utilization of bell mouth suction manifold in conjunction with improved impeller design—the latter feature making

HEAVY DUTY SERVICE TYPE



DRIVES: Standard vertical hollowshaft motor; Peerless' *exclusive* vertical hollowshaft Moturbo drive; Peerless vertical hollowshaft right angle gear drive.

CAPACITY RANGE: Up to 8,000 gpm.

HEAD RANGE: Up to 300 psi.

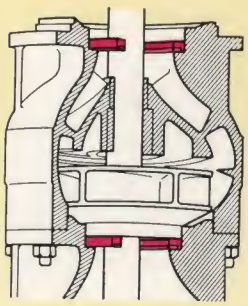
LIQUIDS HANDLED: Clear water, alkaline liquids.

APPLICATION: Municipal and industrial pit, sump and basin pumping. Boosting, line pumping, recirculation.

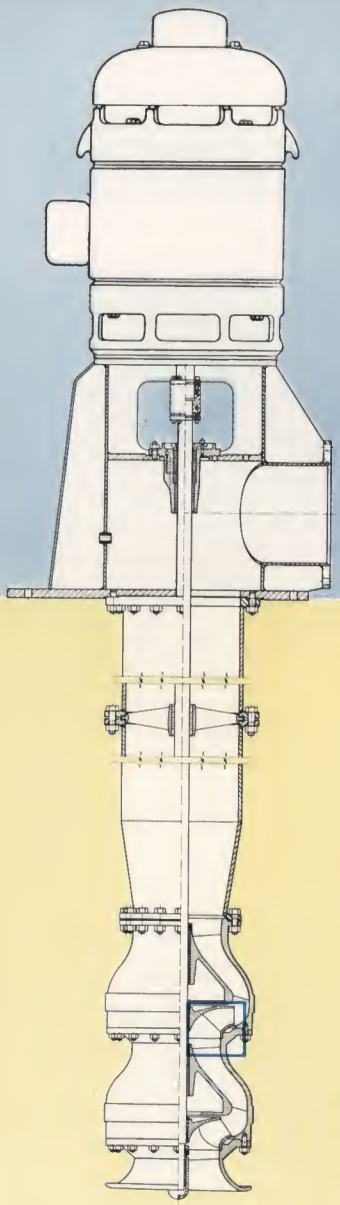
COLUMN: Threaded column construction with long rubber lineshaft bearings is standard.

MATERIALS OF CONSTRUCTION: Standard vertical turbine pump fittings, including steel column and shafting, iron bowls, bronze impellers. Bowl units can be all iron or all bronze if required.

BOWL UNIT: Standard all iron casting with bronze impeller. Bowl bearings are both rubber and bronze.



EXTRA HEAVY DUTY SERVICE TYPE



DRIVES: Standard vertical solid shaft or vertical hollowshaft motor; Peerless' *exclusive* hollowshaft Moturbo drive; Peerless hollowshaft right angle gear drive.

CAPACITY RANGE: Up to 40,000 gpm.

HEAD RANGE: Up to 500 psi.

LIQUIDS HANDLED: Clear water and alkaline liquids.

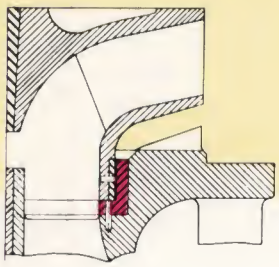
APPLICATIONS: Cooling tower basin service, heavy-duty industrial boosting pumping.

COLUMN: Flanged column construction with line shaft bearings of materials to suit liquid being pumped.

MATERIALS OF CONSTRUCTION: Standard vertical turbine pump fittings including: steel column and shafting, cast iron bowl, bronze impellers. Bowl units can be all iron, all bronze or all steel.

DISCHARGE BASE: Fabricated steel with packing box as shown or with mechanical shaft seal. Flanged or spacer type couplings available.

BOWL UNIT: Standard all iron bowl casting with bronze impellers and with bearing of material to suit liquid being pumped. Bowls and impellers can be equipped with "L" type wear rings as shown.



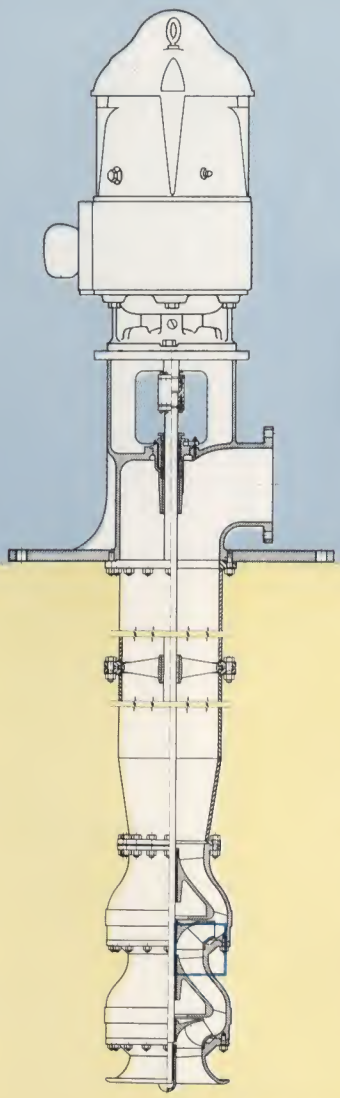
possible installation with the minimum of submergence and the virtual elimination of vortexes at the pump suction.

The Peerless close-coupled, vertical, industrial service, turbine type pump has always been ideal for liquid transfer when short settings are involved. One of the outstanding reasons for its complete acceptance has been that the use of a vertical type pump eliminates the necessity of either all or a greater proportion of system suction piping.

Furthermore, the vertical type design, once primed, eliminates the necessity of further pump priming and permits installation in a restricted space. In addition Peerless' vertical design permits utmost flexibility in adapting the pump to future system needs simply by adding to or subtracting from the number of bowl units (or stages) required by the system's conditions.

These advantages, combined with the proved modern design of the Peerless vertical industrial service pump, recommend a complete and thoughtful analysis of its application possibilities. Engineers should find this modern Peerless pump to be the most efficient, most effective and most economical way to transfer liquids in all installations where short and medium pump settings are involved.

Today the Peerless vertical close-coupled industrial service pump is designed and engineered for an increasing number of industrial process and commercial applications because of its availability in three separate and distinct types—a heavy-duty service type, an extra heavy-duty type, and a special



SPECIAL SERVICE TYPE

DRIVES: Open type standard vertical solid shaft or vertical hollowshaft motor; Peerless' *exclusive* hollowshaft Moturbo drive, or explosion-proof totally enclosed types for hazardous locations. Right angle gear drive and steam turbine drive available.

CAPACITY RANGE: Up to 1,400 gpm.

HEAD RANGE: Up to 300 psi.

LIQUIDS HANDLED: Hydrocarbons, volatile liquids, chemical solutions and other process liquids.

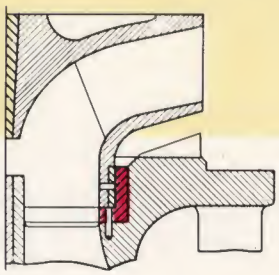
APPLICATIONS: Chemical process transfer services, pumping from tanks and vessels.

MATERIALS OF CONSTRUCTION: Any machinable alloy or combinations to suit the application and liquid being pumped.

DISCHARGE HEAD: Discharge can be at surface or below ground. Packing container construction as shown, or mechanical shaft seal combination is optional. Flanged or spacer type couplings.

COLUMN: Flanged column construction with line shaft bearings of materials to suit liquid being pumped.

BOWL UNIT: Standard bowl casting with enclosed impellers, and with bearings of materials suited to liquid being pumped. Bowls and impellers can be equipped with "L" type wear rings as shown.



service type. The differences in and advantages of each type are fully detailed and described on succeeding pages.

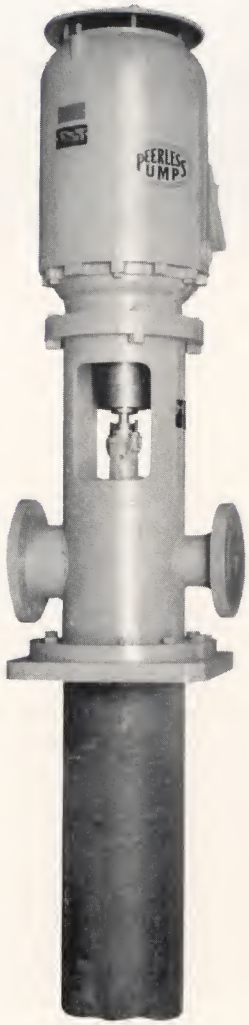
Apply the Peerless vertical industrial service pump where there is a necessity for the versatility, utility, power, capacity and efficiency available only by use of a vertical type pump. It will do the pumping job properly and continuously with a minimum of attention, maintenance and upkeep. It can be applied with confidence that it will measurably lessen the cost, over its extended life, of pumping in all services requiring a proved, quality product.

PEERLESS VERTICAL INDUSTRIAL SERVICE PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-505.

Also described on Page 81

PEERLESS HYDRO-LINE® PUMP

This is an encased vertical centrifugal muli-stage, close-coupled turbine pump, especially suited for applications where available net positive suction head is limited and where space is at a premium. Completely self-enclosed, the Hydro-Line consists of a vertical, close-coupled rotative shaft turbine pump enclosed in a steel jacket or barrel. This pump can be removed from the line with minimum of trouble. The Hydro-Line pump is easy to install and maintain.



Pump and motor are connected by couplings, easily accessible by means of generous-sized handholes. All types of drive can be utilized.

Capacities up to 5000 gpm, with heads up to 1000 feet.

Stuffing box is extra deep to minimize leakage in conventional installations. Mechanical seal can be utilized where desired.

Column and bowl assembly are designed and constructed of materials as indicated for the particular application.

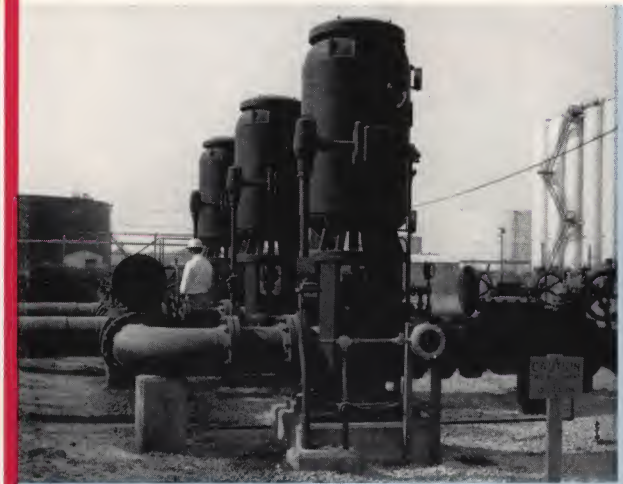
Impeller shaft is stainless steel.

Standard bowl and other bowls are manufactured of a close-grained high tensile strength cast iron.

Impellers are of high grade alloy bronze, designed, with the entire pump, for long life and trouble-free operation.

Special material and alloys can be furnished when required.

Especially suitable for pumping Hydrocarbons, such as Gasoline, Propane, Butane, Oils, etc., Hot or Cold Water, Acids, Bases, Salt Solutions.



Handling liquefied petroleum gases for industries and municipalities, as well as for domestic supplies, presents no problem for Peerless vertical Hydro-Line pumps. This view shows three of them in action handling LP-gas in a major oil company's bulk handling plant.

PEERLESS HYDRO-LINE VERTICAL CENTRIFUGAL PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1700

Also described on Page 81

PEERLESS VERTICAL MINE PUMPS

In no field of operation does the efficiency and stamina of a modern pump receive a more rigorous test than in the dewatering of coal mines in the anthracite fields of Pennsylvania. In this field, where tough dewatering problems are not unusual, the name "Peerless" stands as a widely accepted criterion of dependability where the pump alone often stands between operable mine workings and the vast subterranean reservoirs which constantly threaten them with inundation. Having proved themselves for years, in the difficult testing ground of the Eastern anthracite mining field, Peerless vertical mine pumps present themselves against this critical background, to prove their leadership in this, as in many other fields. In general, these pumps are similar in construction to regular deep well turbine pumps, described previously.

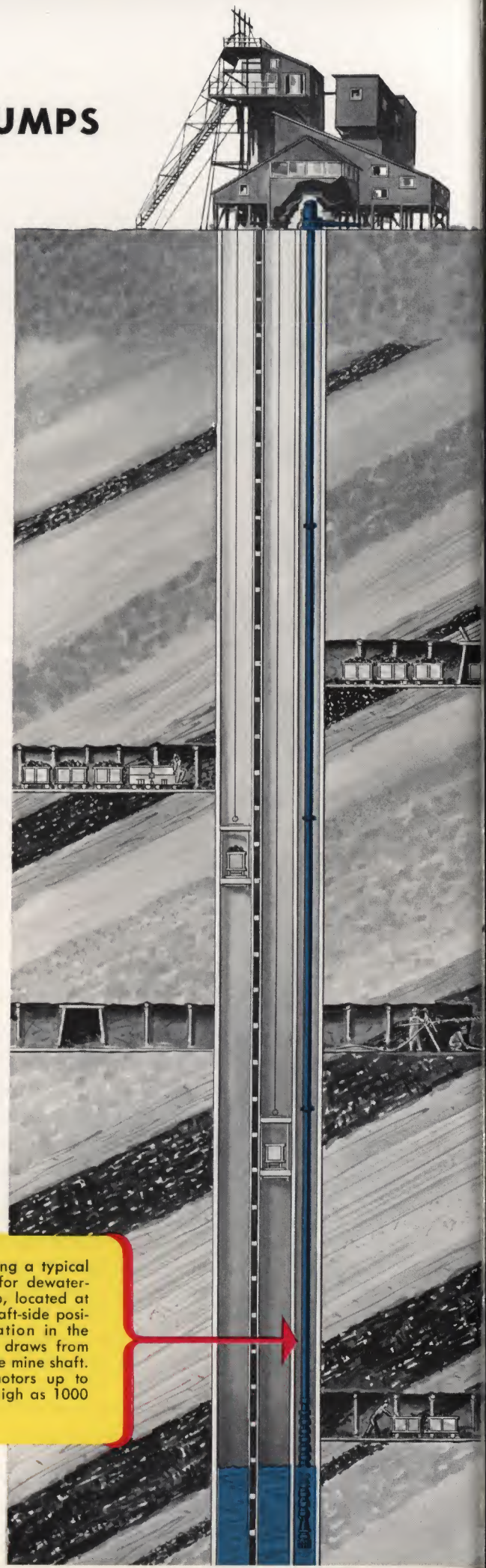
Pumps for dewatering purposes require the most dependable equipment. Peerless has furnished many pumps for this service, in units ranging from 5 to 700 hp.

Mine sinking pumps can be designed to hang suspended from the surface of mine shafts, or installed permanently on foundation above the high water level. Where mine sinking pumps are required to hang from the surface, Peerless can design and furnish special metal slings to meet individual requirements. Where permanent installations are made, set on a foundation, special attention is given to accessible means of disconnecting various parts of the pump, to permit ease of handling in the shaft. Peerless' high efficiency in mine dewatering pumps reduces kilowatt consumption and has proved to be the most economical and dependable equipment for this service. Where chemicals or corrosive acids are encountered in the mine water, Peerless is prepared to build pumps with special metal and rubber linings in discharge and column to combat the destructive action of these substances.

In a report of investigations of deep well pumps and shaft pumps in the anthracite mines of Pennsylvania by William H. Lesser, Consulting Mechanical Engineer of the U. S. Bureau of Mines, late in 1949, Mr. Lesser says: "The general design of the 'Peerless' deep well pump, a type commonly used in the Pennsylvania anthracite region, involves design



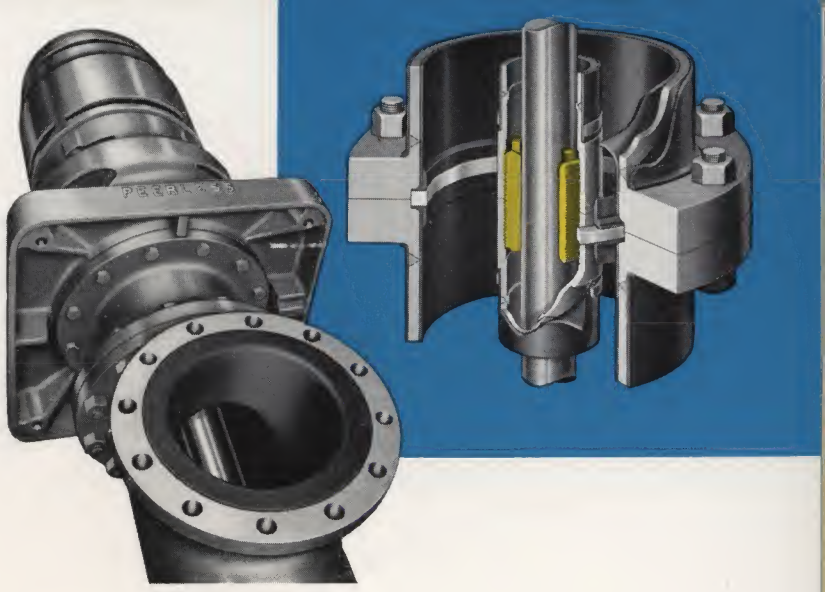
This photograph of a Peerless vertical mine pump was taken at the foot of the shaft of Philadelphia & Reading Coal & Iron Co., Pottsville, Pa. This is a 20-inch pump, capacity 5,000 gpm operating against a head of 480 feet.



A schematic drawing showing a typical Peerless pump installation for dewatering a coal mine. The pump, located at the headworks, is over a shaft-side position, clear of cage operation in the shaft. The pump assembly draws from the pool at the bottom of the mine shaft. Direct-connected electric motors up to 700 hp lift mine water as high as 1000 feet.

of the following important elements: an efficient multistage pump; eduction pipe strong enough to support its own weight and that of the pump; enclosed pump-shaft oil tubing; adjusting nut for positioning impellers; pump shaft; and head casting for supporting the motor. Of definite importance are the design of the bearings and the selection of an efficient method of lubricating them."

Peerless pumps, installed in mines where dewatering is a problem, maintain the level of the underground mine pools at a point where they will not overflow into the workings being protected by the pump on the job. Peerless 20-inch pumps, listed in the Department of Interior report, have capacities as high as 5,000 gpm pumping against a 480 ft. head with 600 hp motor. In the case of a 20-inch Peerless pump, pumping against a 500 ft. head with 700 hp motor, this unit operated for 95% of the report period. Removal of the pump for examination after 2 years use was made during a 48-hour period. Pump casing with its 10 stages of impellers and suction strainer was replaced with an entirely new unit. The used impellers and casing were removed for reconditioning, however, were found to show no signs of wear. This pump had operated 14,703 hours and had handled 4,136,310.000 gallons of water and after two years of service the pump was considered to be in excellent condition, as attested to in the Lesser report.



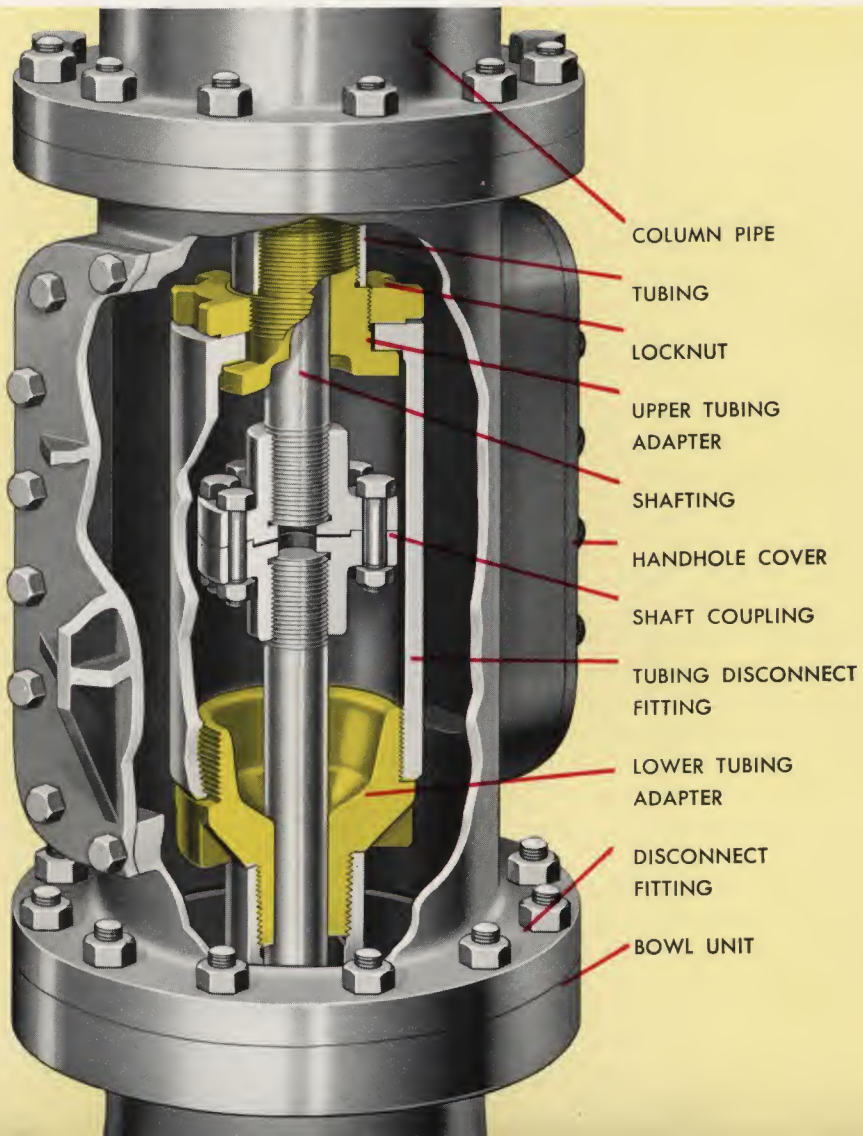
RUBBER LINED

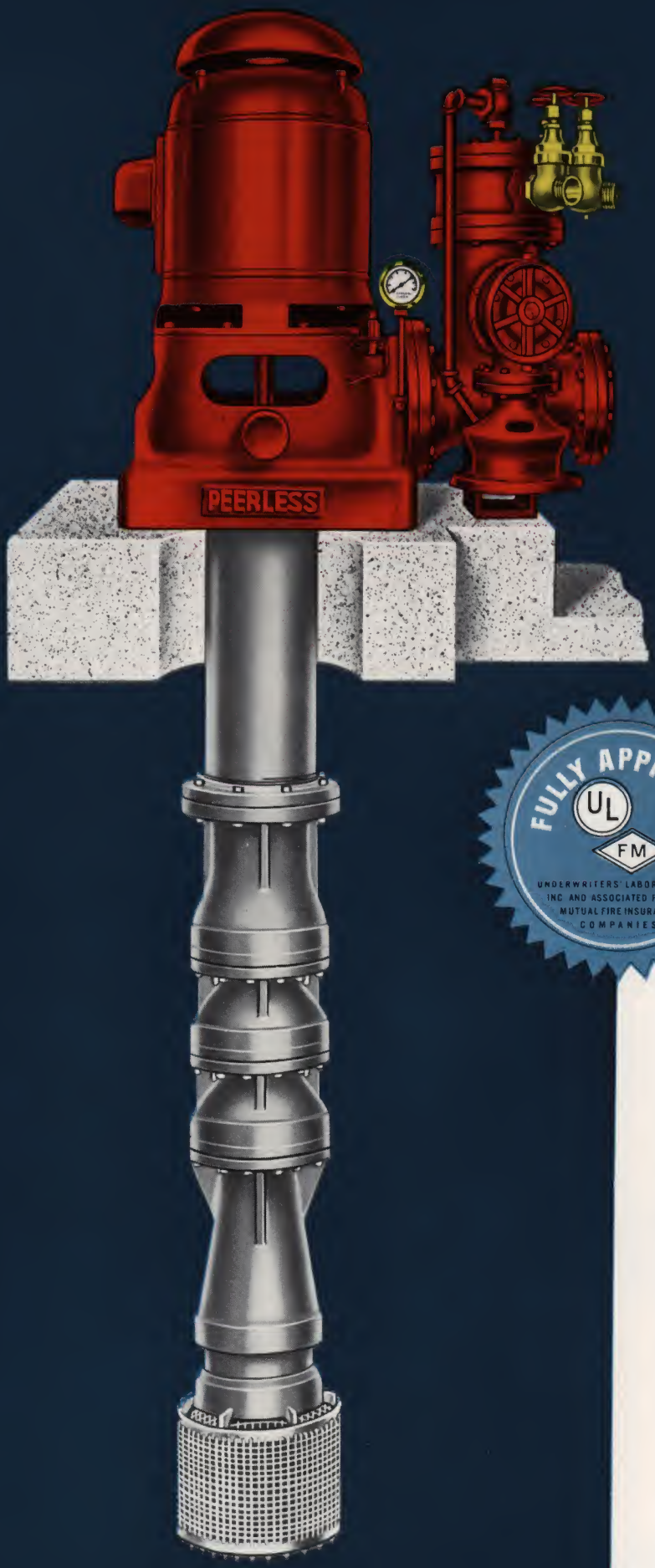
Underground mine water frequently is relatively high in acid content, requiring special protection for pump parts exposed to this action. Where special acid-resisting metals are not used, Peerless engineers have devised a protective coating of rubber, which is bonded to metal surfaces and when exposed to the water prolongs their life and makes possible long, trouble-free mine pump operations against the hazard of acidic water. Note in the views above that both the pump discharge and inside of the pump column and the exterior of the oil enclosing tube are so treated with rubber. Experience has shown this to be a most satisfactory way of handling corrosive mine water.

MINE DISCONNECT DEVICE

In order that the bowl unit can readily be disconnected from the pump column and shafting, Peerless utilizes this mine pump disconnect device, permitting removal of bowl unit for inspection and repair should it be necessary. Exterior sketch below shows the relative position of the mine disconnect device in relation to the bowl units. The cutaway view at the right shows the mine disconnect device in detail. Generous-size handholes are provided to permit the disconnect to be made with a minimum of hazard and in the least time.







THE SEAL OF APPROVAL for Fire Pumps, by Underwriters' Laboratories, Inc. and Associated Factory Mutual Fire Insurance Companies, Inc., bestows on a pump the fullest measure of fire protection confidence. Fire fighting equipment must be dependable. It must be ready to give instant service in an emergency and because it is seldom used, it must require the very minimum of maintenance care.

PEERLESS VERTICAL TURBINE FIRE PUMPS have won the Underwriters' approval because they are built of finest materials, with the utmost care in workmanship. Peerless modern pump engineering skill invests these pumps with greatest instant-action efficiency. They require a minimum of maintenance attention. And, because such equipment may stand unused for long periods of time, Peerless Turbine Fire Pumps are fully protected from the harmful effects of dust and moisture, to eliminate any possibility of deterioration when not in service. **They are built for instant action.** Capacities range from 500 to 2500 gpm, to operate against heads from 240 to 285 feet, or higher.

PEERLESS
VERTICAL TURBINE FIRE PUMPS



Peerless vertical turbine fire pumps are especially suited to pumping from reservoirs, tanks, sumps, lakes, rivers, or wells. Oil- or water-lubricated types are available. Electric drive, right angle gear drive, or steam turbine drive, may be selected. Underwriters' Laboratories, Inc. has approved both methods of lubrication as well as all the above-mentioned types of drive.

Peerless vertical turbine fire pumps are available in rated capacities from 500 to 2500 gallons per minute to provide 100 pounds or more pressure at the discharge. The number of stages to provide the desired capacity at 100 pounds or more pressure will be dependent upon the distance from the center line of discharge to the water level in the source of water supply. The nominal motor speed in all cases must not exceed 1760 rpm.

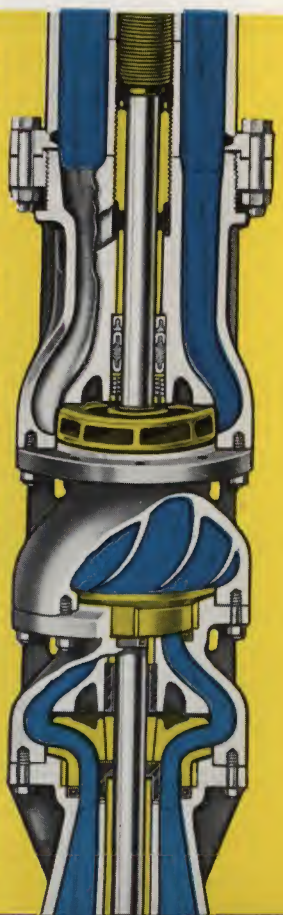
Peerless turbine fire pumps are technically designated as centrifugal pumps of the vertical shaft turbine type. **They are fully automatic.** The compact design of the discharge head permits installation in a minimum floor space. Discharge piping is simplified.

In addition to approval by Underwriters' Laboratories, Inc., Peerless vertical turbine fire pumps are also fully approved by the Associated Factory Mutual Fire Insurance Companies, Inc. The sole difference in the approval of Peerless specifications, as outlined herein, by both of the above organizations, is that the Associated Mutual Fire Insurance Companies, Inc. require the use of genuine wrought iron or copper bearing steel column pipe in the construction of a fire pump.

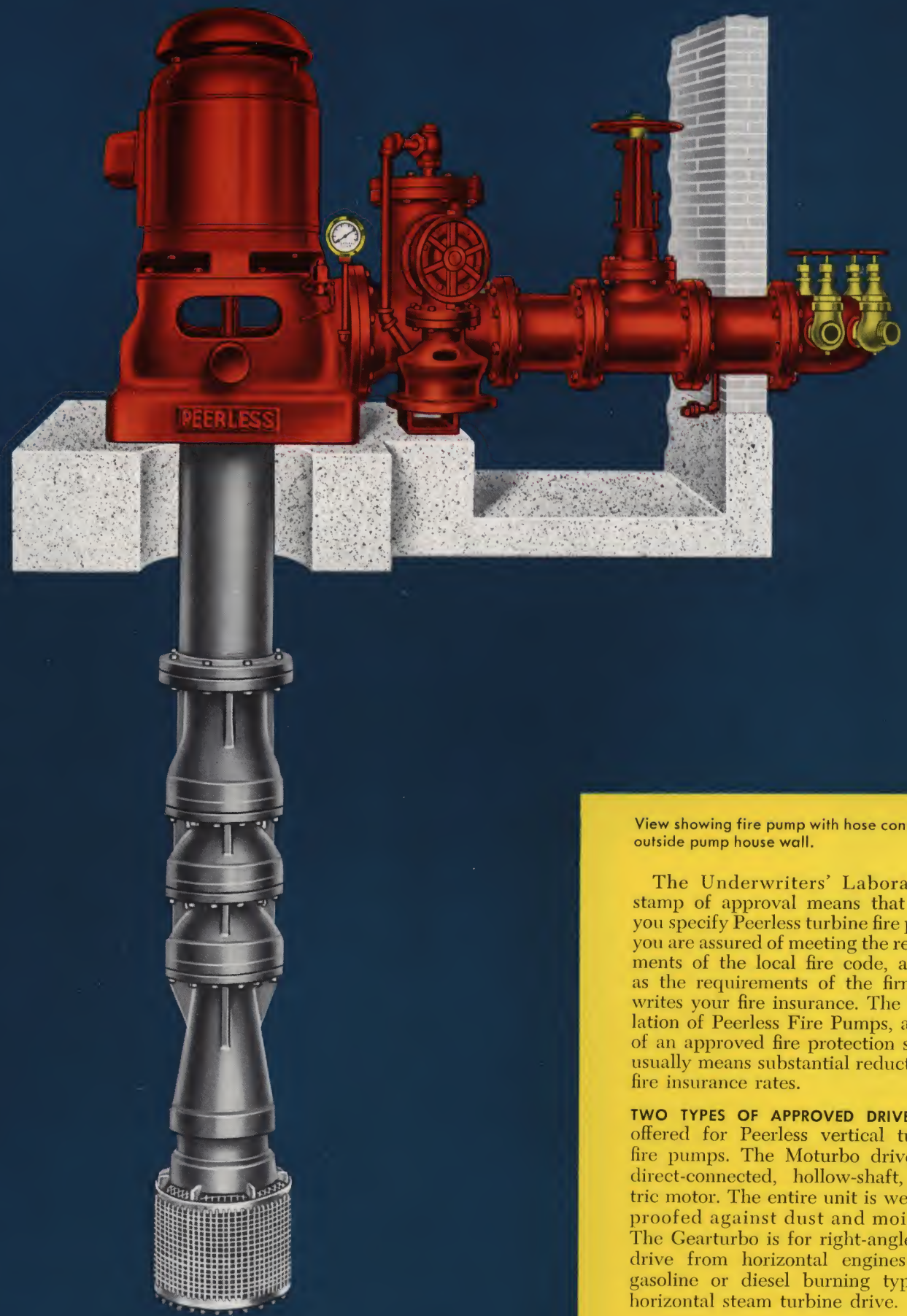
The requirements of each fire pump installation are different. Safety codes, in a given area, may differ from others. Particular needs for a given fire fighting job are often unusual. To meet the requirements of all specifications, Peerless offers a variety of fire pumps. In addition to the vertical turbine fire pumps, Peerless also manufactures horizontal centrifugal fire pumps in accordance with Underwriters' approval. These horizontal pumps are described on page 64.

Peerless engineers will gladly assist a customer in selecting the proper pump to meet his stipulated requirements for fire protection in any area.

Peerless pumps are designed for the specific requirements of fire protection service. They are constructed of the best materials and with the finest workmanship.



Cutaway view of the oil-lubricated vertical turbine type fire pump showing construction details of the Peerless column, shaft enclosing tubing, and line shaft and method of supplying oil to shaft bearings. To counteract any abrasive wear which might occur between the metal-to-metal side seal (between impeller skirt and bronze wearing ring on bowl), Peerless provides a patented Double-Seal. This Peerless feature contributes both to long life and to the maintenance of the original capacity and efficiency of the pump.



View showing fire pump with hose connections outside pump house wall.

The Underwriters' Laboratories stamp of approval means that when you specify Peerless turbine fire pumps you are assured of meeting the requirements of the local fire code, as well as the requirements of the firm that writes your fire insurance. The installation of Peerless Fire Pumps, as part of an approved fire protection system usually means substantial reduction in fire insurance rates.

TWO TYPES OF APPROVED DRIVES are offered for Peerless vertical turbine fire pumps. The Moturbo drive is a direct-connected, hollow-shaft, electric motor. The entire unit is weatherproofed against dust and moisture. The Gearturbo is for right-angle gear drive from horizontal engines; gas, gasoline or diesel burning types or horizontal steam turbine drive.

TWO BASIC TYPES OF LUBRICATION make oil or water lubrication optional. The oil-lubricated type embodies an enclosed shaft in which bronze bearings are lubricated by oil. In the water-lubricated type, rubber bearings are lubricated by the water being pumped.

WATER-LUBRICATED TYPE PUMP DETAILS OF CONSTRUCTION

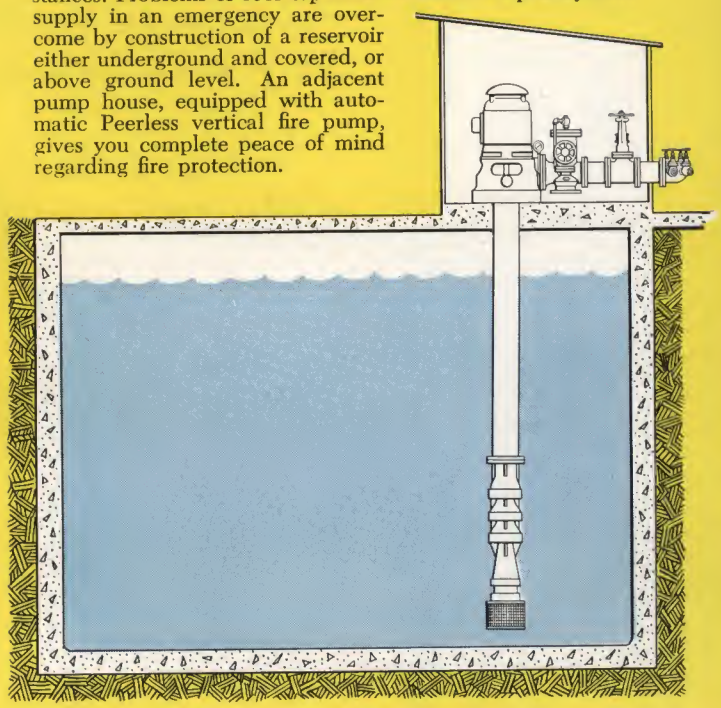
PACKING GLAND—Water leakage around the drive shaft is reduced to a minimum by use of an extra long packing box. The packing is under the constant pressure of a stainless steel spring which automatically compensates for wear. The head shaft, which passes through the packing gland and guide bearing, is corrosion-resistant steel.

LINE SHAFT BEARINGS—Long cutless fluted rubber bearings, starting at five feet below the pump head, are spaced at ten-foot intervals down to the lowermost bearing, which is located five feet above the bowl unit. A close-operating clearance is maintained between the shaft and the rubber bearings, and the bearings are rigidly held in bronze spiders which eliminate whipping and vibration of the shaft.

OTHER COLUMN FEATURES—Line shaft is heavy turned-ground-and-polished precision stainless steel of high tensile strength and uniform quality. Line shaft couplings are machined from solid stock. Shaft couplings and shaft threads are machined to hardened gages. Shaft ends counterbored to insure accurately aligned, butted connections. Column pipe construction is of welded flange type with register fits to insure alignment.

YOUR OWN STAND-BY FIRE PROTECTION SYSTEM INDEPENDENT OF WATER MAINS

For completely independent fire protection at your plant, warehouse or storage area, the pump-and-reservoir plan provides an immediate water supply under any circumstances. Problems of roof-top tanks or reliance upon hydrant supply in an emergency are overcome by construction of a reservoir either underground and covered, or above ground level. An adjacent pump house, equipped with automatic Peerless vertical fire pump, gives you complete peace of mind regarding fire protection.



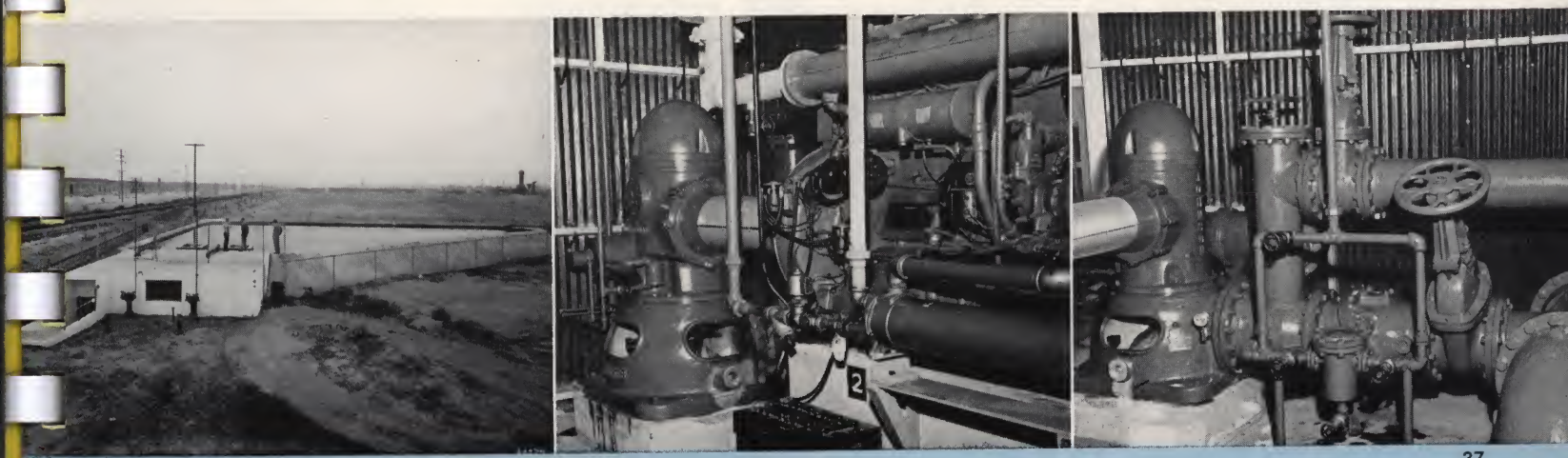
OIL-LUBRICATED TYPE PUMP DETAILS OF CONSTRUCTION

SHAFT LUBRICATION—A water-cooled oil reservoir in the discharge assembly (pump base) supplies a predetermined amount of oil to the shaft bearings by means of an automatic drip-feed lubricator.

SHAFTING—Turned-ground-and-polished precision steel line shafting of high tensile strength and uniform quality is used because it is the only material that will meet Peerless specifications for straightness and exact diameter. All shaft couplings are machined and counterbored for accurate alignment. All couplings and shaft threads are machined to hardened gages.

BEARINGS—The shaft-bearings, made of special composition bronze, are machined to extremely close fits for smooth operation. A spiral groove is machined in the bearing to facilitate positive and uniform flow of oil over the bearing surface, and a longitudinal hole in the wall of each bearing bypasses oil to the next bearing below.

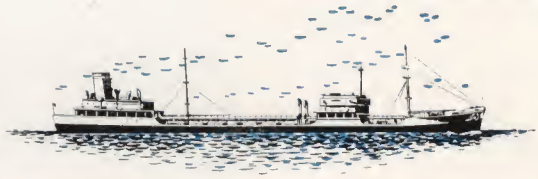
PEERLESS VERTICAL TURBINE FIRE PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-152.



An independent fire protection system reservoir and right angle gear drive pump used in the system shown here are in service for a chain grocery distributing center located beyond city water mains.

PEERLESS GASOLINE AND FUEL TRANSFER PUMP

An ideal pump for bulk loading and transfer for airfield and shipboard installation. Underwriters' Approved drives.





HEADS	*20 to 400 ft.*
CAPACITIES	*30 to 1500 gpm*
DRIVES	*Explosion-proof, direct-connected electric or right-angle gear (Gearturbo) drive*
ALWAYS PRIMED	

On preceding pages the qualities and characteristics of Peerless vertical industrial service pumps have been shown. These same useful pumps can also be applied to transferring volatile liquids rapidly and safely, either in direct refueling at airfields or in transferring gasoline or fuel oil in marine use.

The Peerless gasoline and fuel pump was originally designed and pioneered prior to World War II. The pump was created primarily to meet needs of Army and Navy for airfields. Later they were applied to marine service. The responsibility which this demand implies has caused Peerless to exert its engineering skill and know-how to supply a pump which promises flawless operation and simplicity of maintenance.

Capacities of these vertical transfer pumps range from 30 to 1500 gpm for pumping against heads from 20 to 400 ft. The three components of the vertical fuel pump are the head, the column and the bowl unit. Peerless transfer pumps are available with two types of heads, referred to as the airfield and tanker types, from wartime applications. The tanker type is of extra heavy construction to withstand severe shocks on shipboard and has a separate base flange which permits the pump head to be removed without disturbing the deck seal. The airfield type is also extra heavy cast iron, to withstand unusual shock.

Vertical explosion-proof motors, Underwriters' approved, are mounted on a base of exceptionally sturdy construction, and ample wall thickness and ribbing, to withstand all strain incident to the intended service. The stuffing box is exceptionally deep to prevent liquid leakage, is gas-tight and requires a minimum of attention or adjustment. Whether the pump driver is of the conventional vertical explosion-proof electric motor type, or the right-angle Gearturbo type, the driver is protected against reverse rotation by anti-reverse ratchet or locked type shaft couplings.

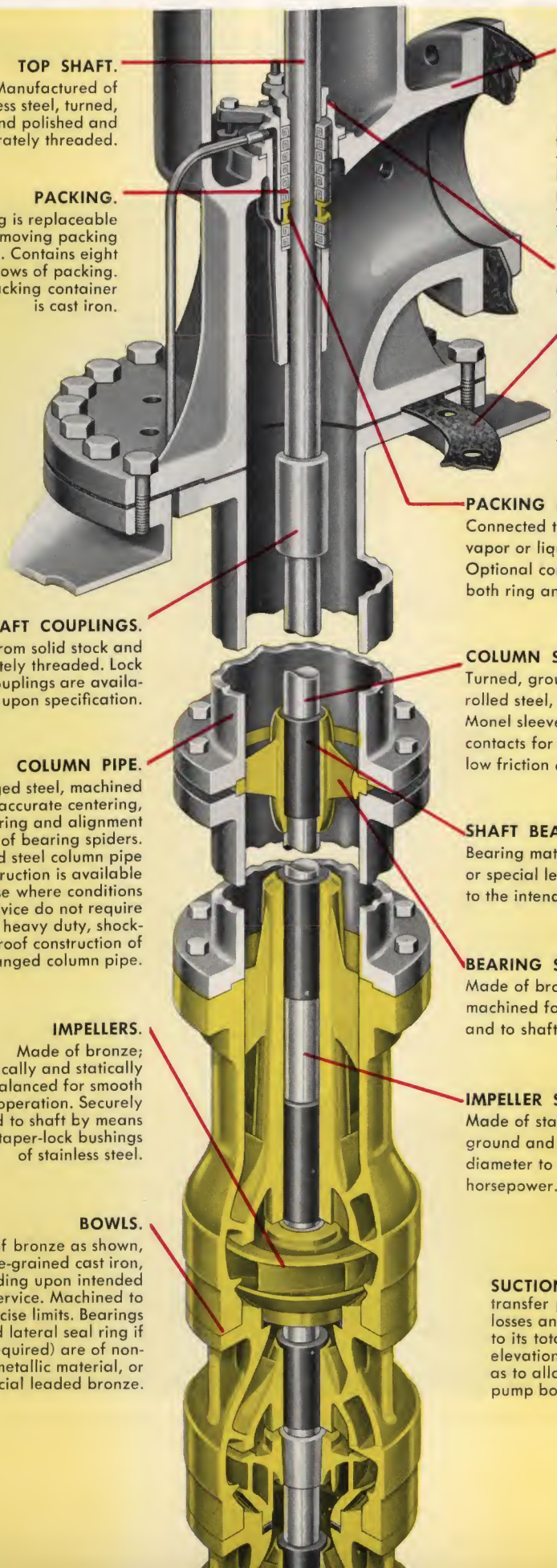
In the assembly of column and bowl units of these fuel pumps, the same exacting care, described in the manufacture of vertical industrial service and fire pumps, is maintained, with special consideration of such structural reinforcement as has been deemed necessary to fully protect these units from their application hazards.

PEERLESS GASOLINE AND FUEL TRANSFER PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NOS. B-2522 AND B-500.



The space-saving feature of the Peerless gasoline pump commends itself to operational authorities of airports, civil or military. This, with the proven reliability and easy maintenance of these fuel handling pump units, mark them for approval by all those who have to know what a pump can do, and how well it can be relied upon to do it. The three pumps installed at the right are used for transferring aviation gasoline at a municipal airport.

HOLLOWSHAFT MOTOR DRIVE; TANKER TYPE CONSTRUCTION



TOP SHAFT. Manufactured of stainless steel, turned, ground and polished and accurately threaded.

PACKING. Packing is replaceable without moving packing container. Contains eight rows of packing. Packing container is cast iron.

SHAFT COUPLINGS. Bored from solid stock and accurately threaded. Lock type couplings are available upon specification.

COLUMN PIPE. Flanged steel, machined for accurate centering, registering and alignment of bearing spiders. Screwed steel column pipe construction is available for use where conditions of service do not require the heavy duty, shock-proof construction of flanged column pipe.

IMPELLERS. Made of bronze; hydraulically and statically balanced for smooth operation. Securely fastened to shaft by means of split taper-lock bushings of stainless steel.

BOWLS. Made of bronze as shown, or close-grained cast iron, depending upon intended service. Machined to precise limits. Bearings (and lateral seal ring if required) are of non-metallic material, or special leaded bronze.

DISCHARGE CASTING. Of extra heavy construction. Made of cast iron. Shipboard or tanker type shown differs only from airfield type in that tanker type has separate base flange, permitting pump head to be removed without disturbing the deck seal.

PACKING GLAND. Gland is of the split type.

NEOPRENE GASKETS. Inserted between discharge head and discharge flange and between pump base and tank flange to seal against vapor and liquid leakage.

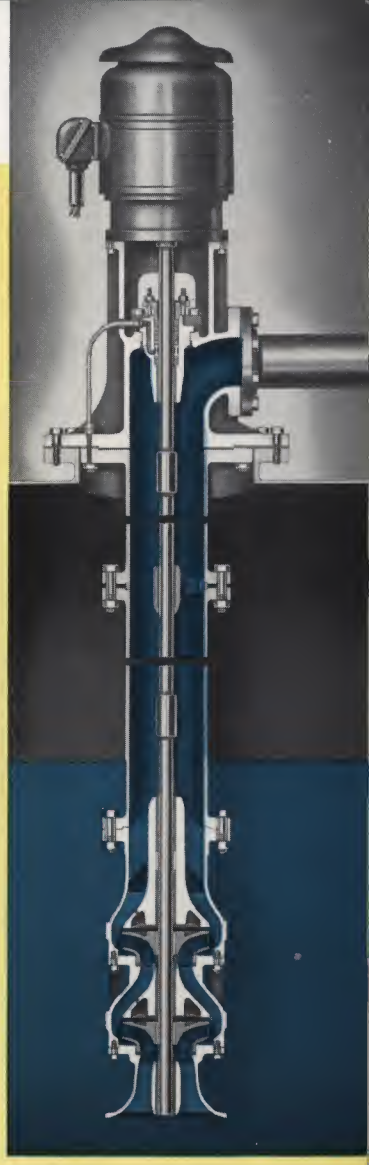
PACKING LANTERN RING. Connected to bleeder line to by-pass vapor or liquids back to pump. Optional construction eliminates both ring and by-pass.

COLUMN SHAFT. Turned, ground and polished cold rolled steel, with chrome plated Monel sleeves at all bearing contacts for heavy service and low friction coefficients.

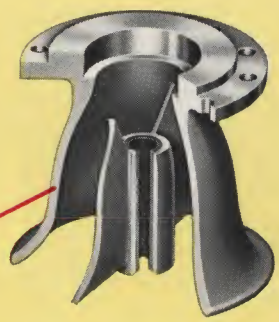
SHAFT BEARINGS. Bearing material is non-metallic or special leaded bronze suitable to the intended service.

BEARING SPIDERS. Made of bronze, accurately machined for register to column and to shaft.

IMPELLER SHAFT. Made of stainless steel. Turned, ground and polished. Of ample diameter to withstand required horsepower.



Cutaway section of Peerless fuel oil transfer and gasoline pump installed shows hollowshaft motor and flanged column pipe construction. Standard solid shaft motors and screwed column pipe construction also available.



SUCTION MANIFOLD. The suction manifold of the gasoline and fuel transfer pump is a special flared type, designed to reduce entrance losses and vortices to practical minimum. Close consideration is given to its total length in order to place the bottom impeller at the lowest elevation consistent with sound practice. The outside diameter is such as to allow the pump to pass through any opening through which the pump bowl units can pass.

THE CHAMPION ...PEERLESS



PLANT WATER SUPPLY IS PUMPED FROM DEEP WELL ON PLANT PROPERTY BY A PEERLESS CHAMPION PUMP

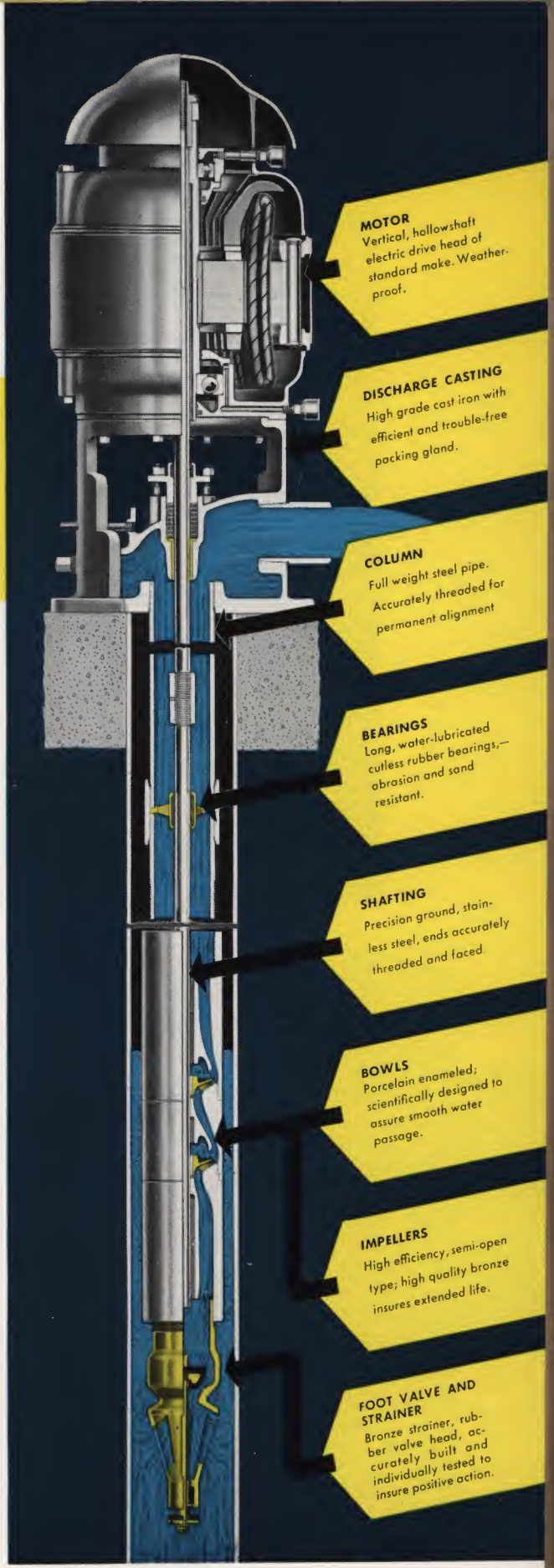
DEEP WELL TURBINE PUMP FOR SMALL DIAMETER WELLS

CAPACITY	*Up to 5000 gallons per hour*
LIFTS	*Up to 200 feet*
PRESSURES	*Up to 90 psi*
DRIVES	*Direct-connected electric motor; right-angle gear drive; V-belt drive*
SIZES	*For drilled wells 4 inches inside diameter and larger*

The Champion, crowned with laurels won in the successful application to small diameter drilled wells, adds to Peerless honors in the deep-well pumping field. Peerless pumps have long been famous for high sustained efficiency, but the Peerless Champion exceeds usual expectations for economy, in small diameter pumps. Many of the proved and successful features of Peerless water-lubricated deep-well turbine pumps are incorporated in the Peerless Champion. This guarantees both construction of top-flight quality underground and water in abundant quantity above ground. The Champion completely meets the need for turbine pump quality, reliability, power and stamina for small diameter drilled wells and represents these qualities in a maximum water supply with modest expenditures for power.

Here is the pump that adequately fills the gap in water capacity often found between the domestic water system and the large deep-well turbine pump, operating in wells 4 inches in diameter and larger.

A good well deserves the best pump and the Peerless Champion can be selected for its measurable economy, utility and flexibility. The Champion produces capacities up to 5000 gallons per hour and provides lifts up to 200 feet. The Champion can also be close-coupled for pumping from pits and sumps for supplying process water where moderate gallonage is required and the amount of solids in suspension is negligible.



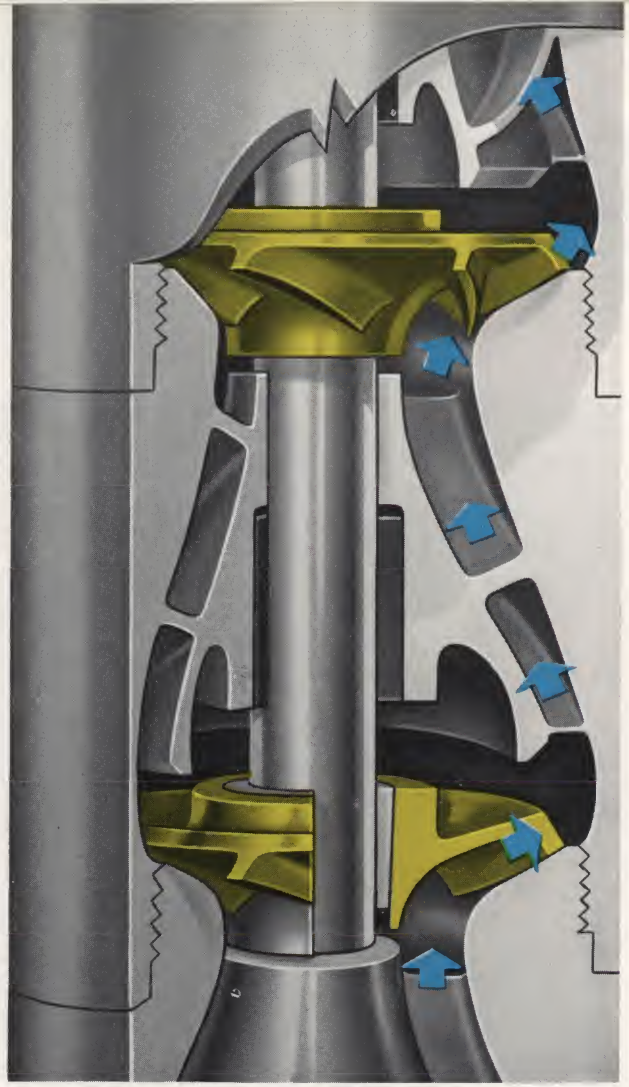
PEERLESS CHAMPION PUMP CONSTRUCTION DETAILS

HEAD: Peerless offers widest choice of drives for all pumping needs. All electrical drives are standard, vertical hollowshaft, weatherproof motors. Adjustment of the pump is easily made by removing canopy and adjusting pumpshaft nut in top of motor. For use with stationary engines, Peerless furnishes the Gearturbo head, the best means of driving a vertical pump from a horizontal shaft. Vee-belt drive is also available. All heads are interchangeable, compact, designed for extended service life.

DISCHARGE: The discharge casting is furnished with either screwed or flanged connections, according to size. It is built to receive all types of drive; electric, gear or belt.

COLUMN: Full weight steel column pipe is furnished standard in 5-foot lengths. Peerless practice includes machining the ends of the column pipe and threading with tapered thread to provide a tight butt joint.

SHAFTING: Peerless Champion shafting is corrosion-resistant stainless steel, much stronger than conventional cold rolled steel. Shaft ends and shaft couplings are precision machined and all shafting is checked for straightness before shipment.

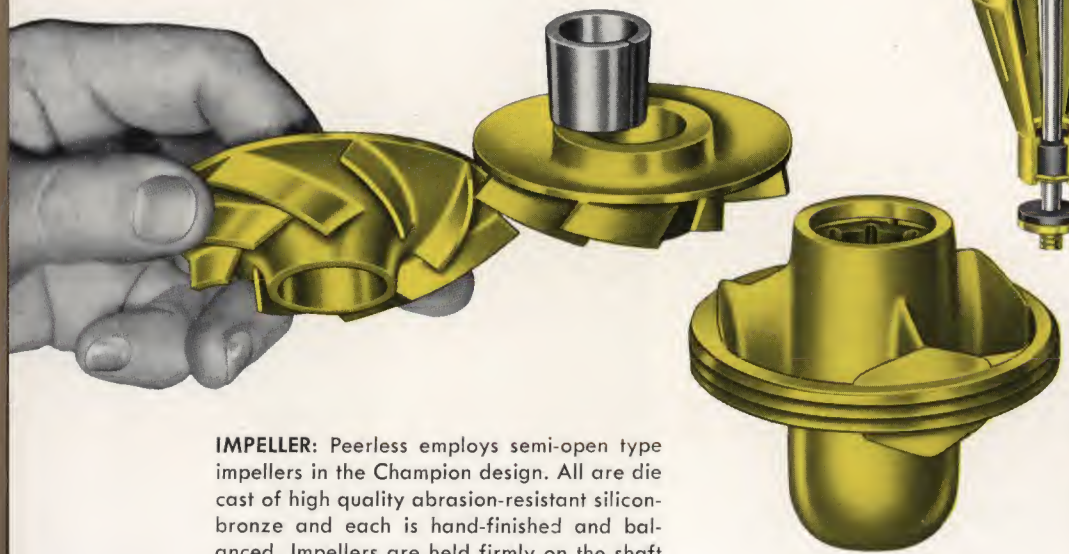


BOWL ASSEMBLY: Peerless Champion pump bowls are of high quality cast iron, cast in Peerless' own foundry. Water passages in the bowl are porcelain-enameled to insure smoothest water flow and enhance pump efficiency. Bowl bearings are cast iron and rubber.



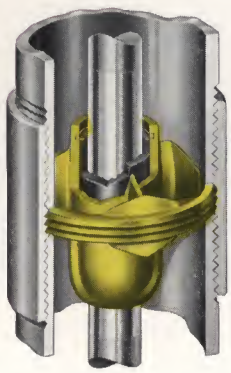
FOOT VALVE: A dual-seated bronze and rubber seat foot valve of special Peerless design keeps water column full, saving time and power and eliminating pre-lubrication. An integral part of the valve is the one-piece, all-bronze strainer.

BEARINGS AND SPIDER: As in all Peerless water-lubricated turbine designs, the Champion utilizes long, fluted cutless rubber shaft bearings, spaced every 5 feet. They are resistant to normal sand and abrasion conditions. Bearings are securely mounted in a heavy bronze spider.

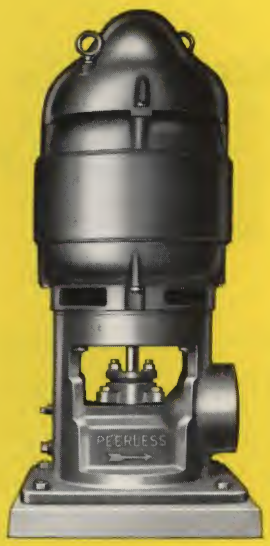


IMPELLER: Peerless employs semi-open type impellers in the Champion design. All are die cast of high quality abrasion-resistant silicon-bronze and each is hand-finished and balanced. Impellers are held firmly on the shaft by ground tapered split bushings, insuring perfect alignment (above).

BEARING AND SPIDER ASSEMBLY



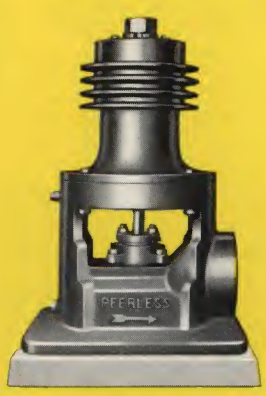
DRIVES: *The Peerless Champion is available with various standard driving arrangements:*



(1)



(2)



(3)

(1) Standard direct-connected electric motor.

(2) Gearturbo head (Peerless' right-angle geared drive) for use with horizontal engine.

(3) Multiple Vee-belt pulley drive.

All heads are weatherproof against the elements, dirt and dust.

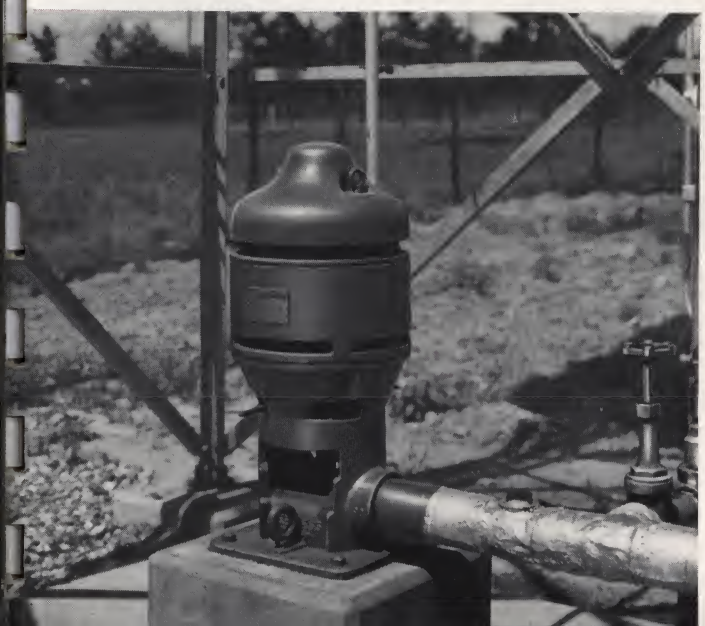
WATER LUBRICATED

The Peerless Champion is an open line shaft pump. Semi-open impellers, streamlined porcelain-enameled bowl sections, rubber bearings all contribute to its smooth water lifting with minimum losses due to turbulence. Bowl and shaft bearings are lubricated by the well's own water. Here is added assurance of not only a clean, oil-free water supply but trouble-free performance underground.

The Champion is especially suited for use with a pneumatic pressure system to supply water for use in homes, estates, motels, etc. It is also particularly adapted to developing water supplies where large volumes are not required, for smaller commercial operations such as bottling works, laundries, public buildings, dairies, for golf courses, swimming pools, and parks, as well as for truck gardening, stock watering and irrigation. The Champion may be close-coupled for pumping from pits or sumps for supplying process water for air conditioning, cooling tower service and other similar installations. With modifications, it can be applied to industrial process work, chemical plants and similar services.

The Champion's high efficiency over its extended service life will reflect both its championship design and quality construction. Peerless Champion owners say that the sustained efficiency and durability of their pumps are exceptional. Here is truly one of the most outstanding pumps in its class.

PEERLESS CHAMPION PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-200.





SUPPLYING WATER FOR AGRICULTURAL USE, ABOVE, OR PUMPING WATER IN AN INDUSTRIAL PROCESS, AT LEFT, ARE ALL IN A DAY'S WORK FOR THE PEERLESS CHAMPION.

THE PEERLESS HI-LIFT PUMP



STREAMLINER PASSES SECTION MAINTENANCE STATION. STATION WATER SUPPLY IS PROVIDED BY A PEERLESS HI-LIFT PUMP.

UTILIZES A UNIQUE POSITIVE DISPLACEMENT PUMPING ACTION TO LITERALLY SQUEEZE WATER UPWARD



CAPACITY	*500 to 3300 gallons per hour*
LIFT	*up to 1000 feet*
PRESSURES	*to 90 psi*
DRIVES	*direct-connected electric motor; right-angle gear drive; V-belt drive*
SIZES	*For drilled wells 4 inches inside diameter and larger*

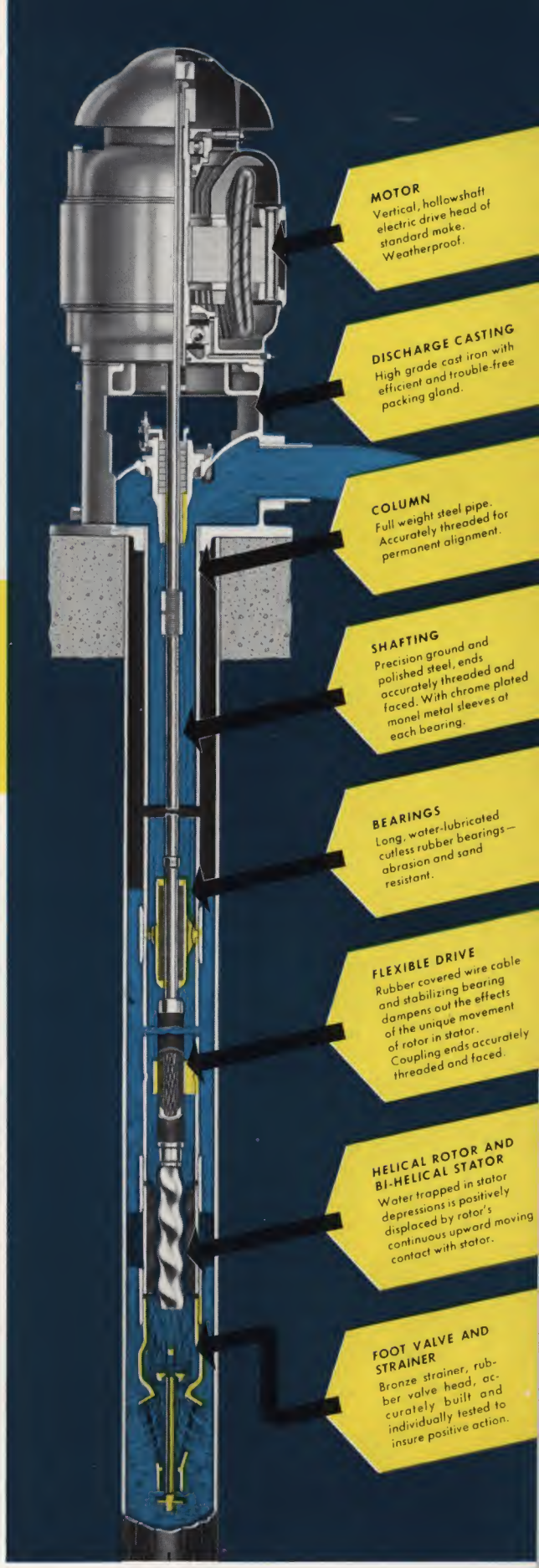
One of the truly new and successful advancements in pump engineering of the past two decades was the application by Peerless of its unique design Hi-Lift pump to water lifting from wells to 1000 feet in depth. The now-famous Hi-Lift has made pumping history in thousands of deep-well installations where the reliability of Hi-Lift operation has proved it to be the kind of pump that can be installed and operated literally independent of attention and maintenance.

In the Hi-Lift, Peerless has brought engineering reliability, operational dependability and simplified pumping, not heretofore economically available, to drilled wells of 4 inches inside diameter and larger.

The principle of the Hi-Lift pump is extremely simple. By using a helically contoured chrome-plated rotor rotating at half the usual small-pump speed, inside of a bi-helically contoured resilient cutless rubber stator, the well water is literally squeezed upward in a continuous, positive manner. The rubber stator and the chrome rotor combine to form a nearly friction-free pumping unit, developing exceedingly high efficiencies.

The Hi-Lift pumping unit has also demonstrated excellent characteristics when applied to wells with water having sand in suspension.

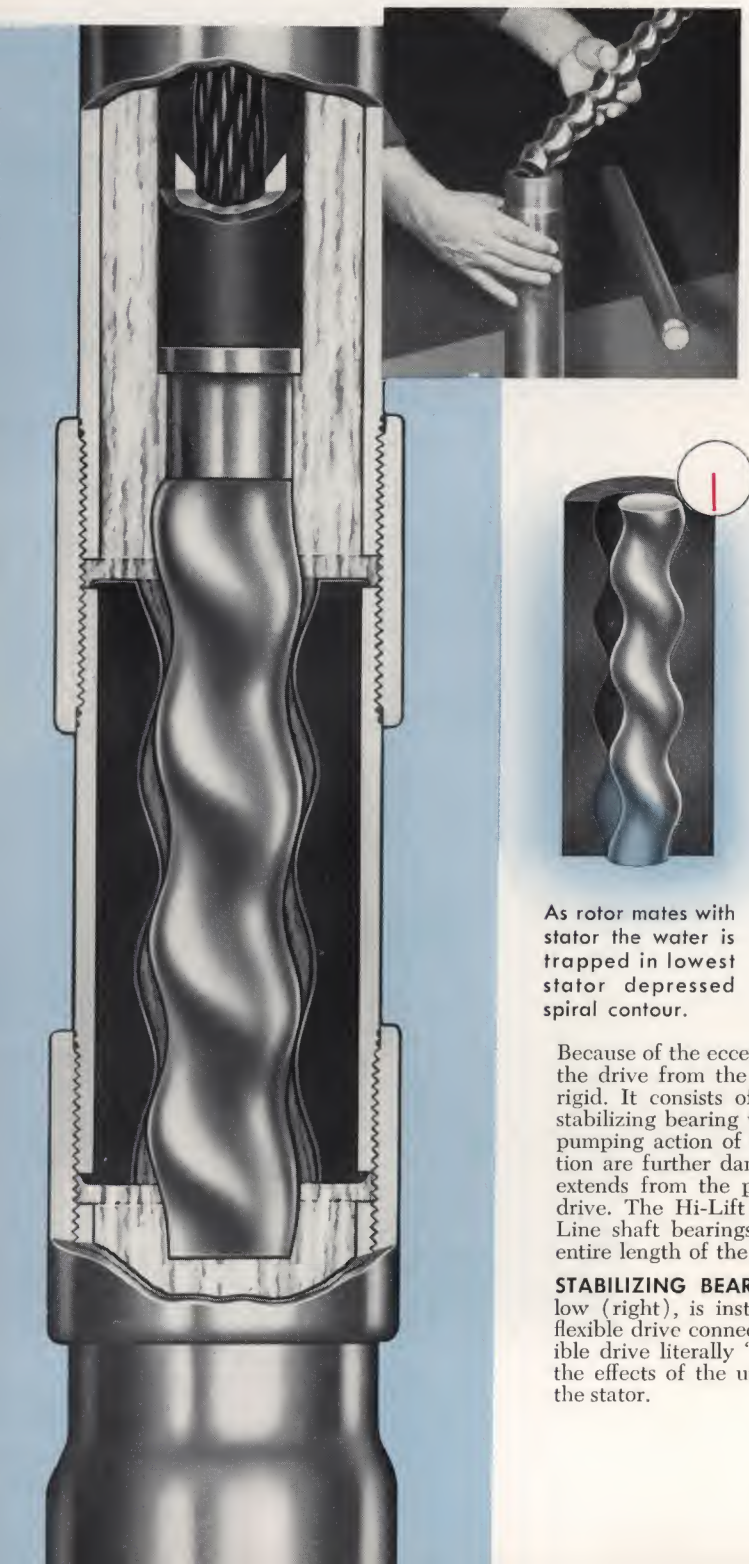
The Hi-Lift is lubricated by the well's own water; there is no possibility of oil contaminating the underground water supply. It is ideal for providing a water supply to small commercial businesses dependent upon an absolutely clean water supply as well as for broad application to farm and domestic use.

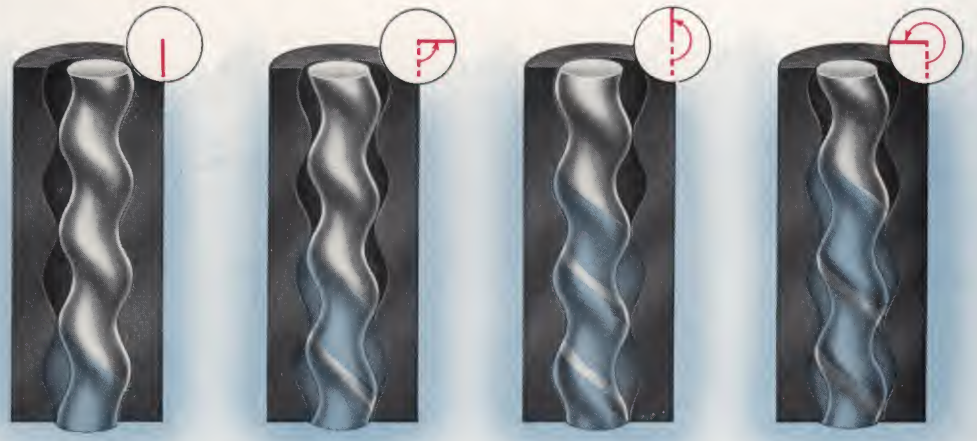


THE POSITIVE DISPLACEMENT PUMPING ACTION OF THE PEERLESS HI-LIFT PUMP

Here is the completely different principle of lifting water as perfected in the Peerless Hi-Lift pump. Hi-Lift's compactness permits installation and successful operation in deeper wells, and those of smaller diameter, than conventional out-moded pumping equipment. "Magic wings" to water lift are given to the water as it is positively and continually displaced upward by Hi-Lift's ingenious yet simply constructed pumping element. Hi-Lift is one of the easiest of deep well pumps to understand, install, operate and maintain.

Hi-Lift's water lifting element consists simply of a revolving element (chrome-plated rotor) with helical rounded spiral contours rising on its exterior surface, turning within a bi-helically contoured stationary element (rubber stator) with upward spiral on its interior surface. The water trapped in the stator depressions is continuously displaced along the stator by the rotor revolving in its upward moving line. The progressive and continuous displacement of the water along the stator is clearly demonstrated in the schematic drawings below, which show the water as it moves upward during three-quarters of one complete revolution of the Hi-Lift rotor within the stator. Drawings below, in half section, show matching of contours of rotor with stator. It must be remembered that the opposite half section would show stator unmatched with rotor thereby effecting a continuous seal so that water can travel upward only.





As rotor mates with stator the water is trapped in lowest stator depressed spiral contour.

A quarter turn of rotor forces water upward along stator spiral contour.

At a half turn rotor mates with stator again and water has risen further along stator.

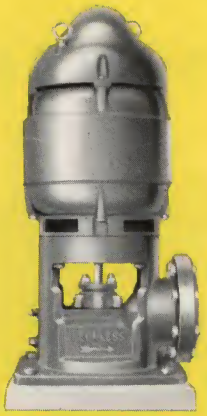
At three quarters turn the displacement through the stator is nearly complete.

Because of the eccentric movement of the rotor within the stator, the drive from the pump shaft to the pumping element is not rigid. It consists of a flexible, rubber-covered wire cable and stabilizing bearing which dampens out the effects of the unique pumping action of the rotor in the stator. Any effects of vibration are further dampened over the length of the shafting as it extends from the pumping element up the well to the pump drive. The Hi-Lift revolves at slow speed, usually 1760 rpm. Line shaft bearings are located every ten feet throughout the entire length of the pump column.

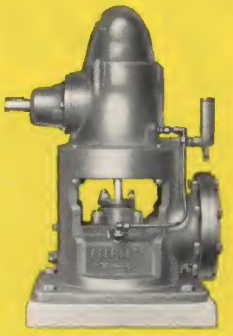


STABILIZING BEARING. This rubber bearing, indicated in yellow (right), is installed midway between the point where the flexible drive connects to the pump shaft and the rotor. The flexible drive literally "rolls" within the stabilizer, thus dampening the effects of the unique movement of the Hi-Lift rotor within the stator.

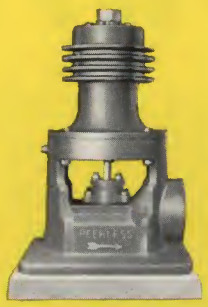
HI-LIFT DRIVES: Drives for the Hi-Lift pump include: direct-connected electric motor, right-angle gear drive and multiple V-belt drive. All heads are weatherproof. Discharge assembly is furnished with screwed or flanged connections depending upon size.



ELECTRIC MOTOR



RIGHT-ANGLE DRIVE



MULTIPLE V-BELT DRIVE

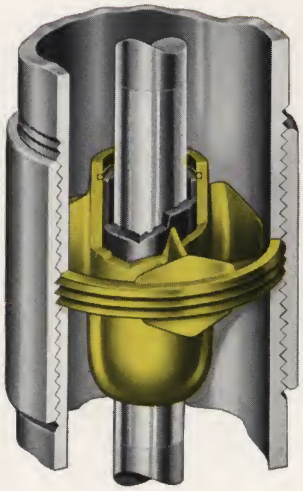


This citrus grove has been brought to production maturity with Hi-Lift irrigation water.

COLUMN PIPE AND SHAFT: The column pipe is screwed into the pump base and suspended vertically into the well. Standard weight pipe is accurately threaded so that when the pipe sections are screwed together their ends may be brought to full abutment, insuring perfect alignment of the shafting. Each length of pump shaft is made from high-grade steel and is turned, ground and polished. One bearing is located at each pipe joint and is firmly supported within the column pipe. Continuous lubrication is provided by the water being pumped.

CORROSION-RESISTANT: Problems of corrosion are minimized in the Hi-Lift. The pump rotor is made of stainless steel and armored with a heavy plating of hard chrome. The shaft is equipped with corrosion-resistant metal, hard chrome-plated, swaged bearing sleeves. Non-bearing surfaces of the shaft are finished with special enamel which gives protection against corrosion.

WATER LUBRICATED: The shaft is stabilized by a resilient fluted-rubber bearing every ten feet. Bearings are self-flushing and lubricated by the water in the well. No oil is required below the surface.

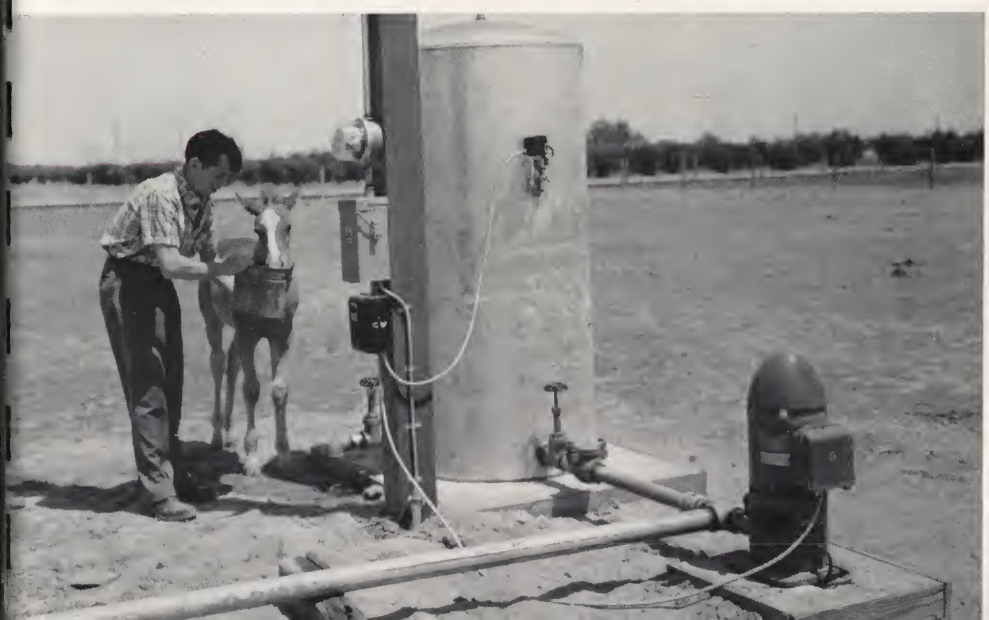


HARD-FACED SHAFT JOURNAL AND RUBBER BEARING. The shaft is equipped with a swaged sleeve which is hard chromium-plated and rotates within a resilient cutless rubber water-lubricated bearing. This patented arrangement is the most indestructible bearing ever devised for deep well pumps.



A new Hi-Lift stands ready to turn arid acres into profitable farm production.

PEERLESS HI-LIFT PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-142.





FOOT VALVE: A spherically contoured rubber valve head, molded over a steel insert, seating on a tapered bronze valve seat keeps water column full, saving time and power and eliminating the need for separate pre-lubrication. This is built integrally with a one-piece, all-bronze strainer.

PEERLESS *Hydro-Foil* PUMPS



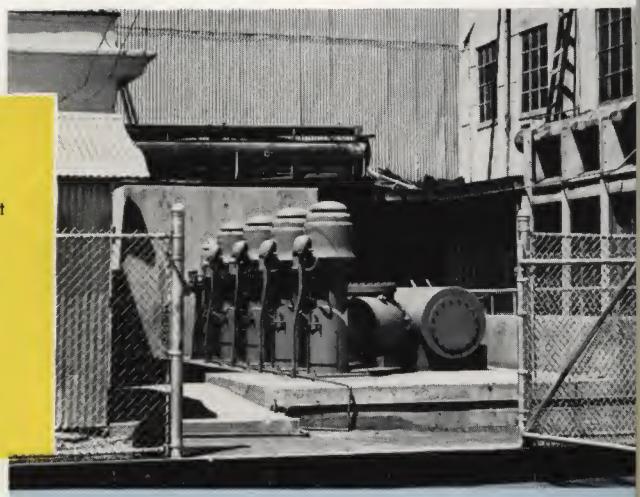
EACH OF THESE 3 HYDRO-FOIL PUMPS INSTALLED FOR DRAINAGE CONTROL HAS A CAPACITY OF 50,000 GPM.

PROPELLER AND MIXED FLOW TYPES

GIANTS IN THE WORLD OF PUMPING WATER IN LARGE CAPACITIES AGAINST LOW AND MEDIUM HEADS

CAPACITY	600 to 220,000 gallons per minute.
HEADS	2 to 60 feet.
DRIVE	Direct-connected hollowshaft or solid shaft electric motors, belt and right angle gear drive from stationary engines.
TYPES	Single- and multi-stage propeller and mixed-flow types.
LUBRICATION	Choice of oil or water lubrication.





Cannery waste products are effectively disposed of by these Hydro-Foil propeller pumps.

Big pumps for big jobs characterize many of the installations of Peerless Hydro-Foil pumps. However the Hydro-Foil pump is also very successfully applied in medium and small sizes to a wide variety of water moving jobs from spinach washing to pumping industrial wastes.

Wherever water must be moved in relatively large volumes against a moderate head, these pumps provide the correct pump application. They are particularly suited to drainage, circulating and flood control applications.

Peerless Hydro-Foil pumps are offered in two types, one is a single-stage and multi-stage propeller type; the other is the mixed flow type, available in both single- and multi-stages.

With the availability of both types of design, users are offered the measurable advantage of flexibility in their choice of a pumping unit for large volume water lifting needs.



Drainage of storm water at a municipal airport is the application of these mixed flow pumps.



These giant pumps were selected for flood control service by the U. S. Corps of Engineers.

Close inspection of the details of Hydro-Foil features in design and construction will reveal advanced principles of hydro-dynamics which heighten pump efficiency and lower power losses and over-all pumping costs.

Because of their widely divergent applications and the unusual abuse to which these pumps may be subjected, extra structural rigidity has been built into each component pump part, allowing high safety factors for any additionally imposed stress in actual operations. When installed these pumps are extremely rugged and structurally stable in their entirety.



PEERLESS MIXED FLOW TYPE PUMPS

Embodying advantageous characteristics of both axial flow and centrifugal pumps, Peerless mixed flow type pumps offer industrial and agricultural users the measurable advantage of flexibility in the choice of a pumping unit most suitable for their specific large volume water lifting needs.

One outstanding advantage of the Peerless mixed flow type pump is its ability to move water against maximum heads with less submergence, permitting the use of shallower sumps and higher speed motors for medium heads with resultant economy of operation and longer pump life. Its use also permits installation in a minimum of space, definitely placing this type of pump in a highly advantageous position for use in many applications heretofore necessitating the use of less efficient and more cumbersome methods of pumping. Peerless mixed flow type pumps are available in single or multi-stage units permitting extreme flexibility throughout a wide range of heads and capacities.

HEAD CONSTRUCTION

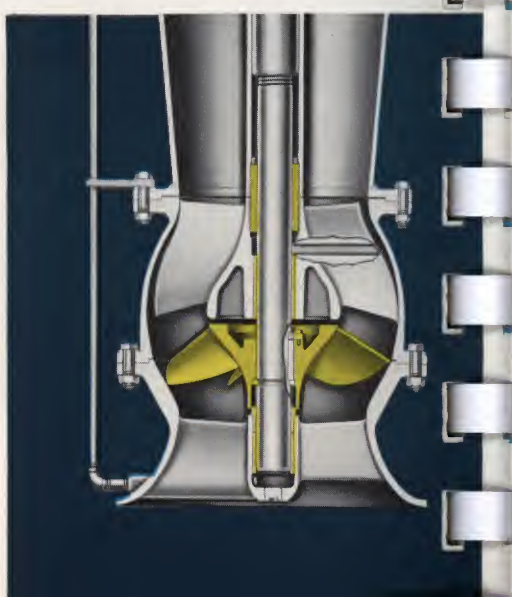
The pump driver may be a vertical hollowshaft electric motor, a solid shaft motor direct-connected to the column shaft, belt drive, or right-angle gear drive. Head construction shown in illustration at left shows a direct-connected hollowshaft electric motor.

The standard type of discharge elbow furnished is a right-angle design, incorporating proper guide vanes to insure smooth flow of water with minimum loss. All elbows are constructed of fabricated steel of proper thickness to withstand all strains incident to its use and are welded to a supporting flange or base plate from which the entire base assembly is hung. Long sweep elbows with various angles can also be furnished when specified.

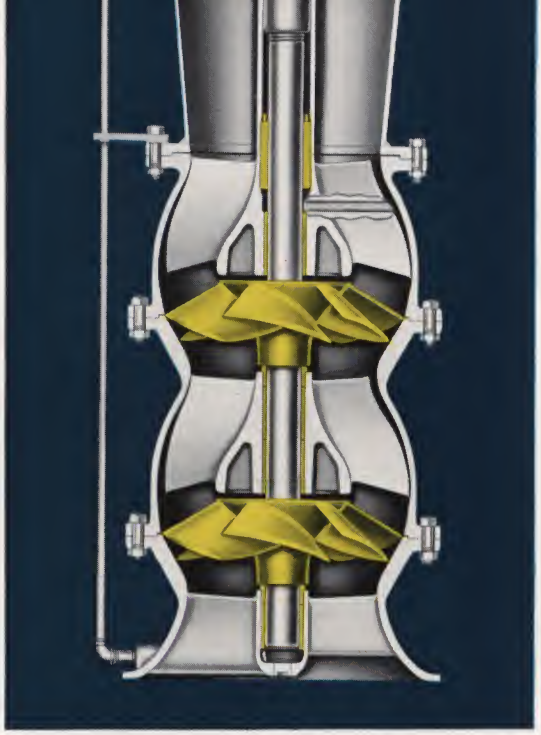
When designed for open line shaft construction, the drive is mounted on a yoke with a packing gland assembly in the base plate readily accessible from the surface. Electric drives are available from 1 to 1000 hp. Right angle gear drives are available up to 300 hp and flat belt or vee pulley heads are available up to 200 hp.

COLUMN CONSTRUCTION

Both column pipe and discharge elbows are normally furnished of fabricated mild steel. Special corrosive resistant alloys can be furnished when the conditions require. The shaft enclosing tubing is extra heavy weight with internally threaded ends to receive shaft bearings at 5-ft. intervals. Bronze shaft bearings serve the double purpose of steady-



The cutaway view at the right is a single-stage, mixed flow bowl unit. At the top of the opposite page is the cutaway view of the two stage, mixed flow bowl unit. The rugged construction features of both single and multi-stage units are readily apparent in these drawings.



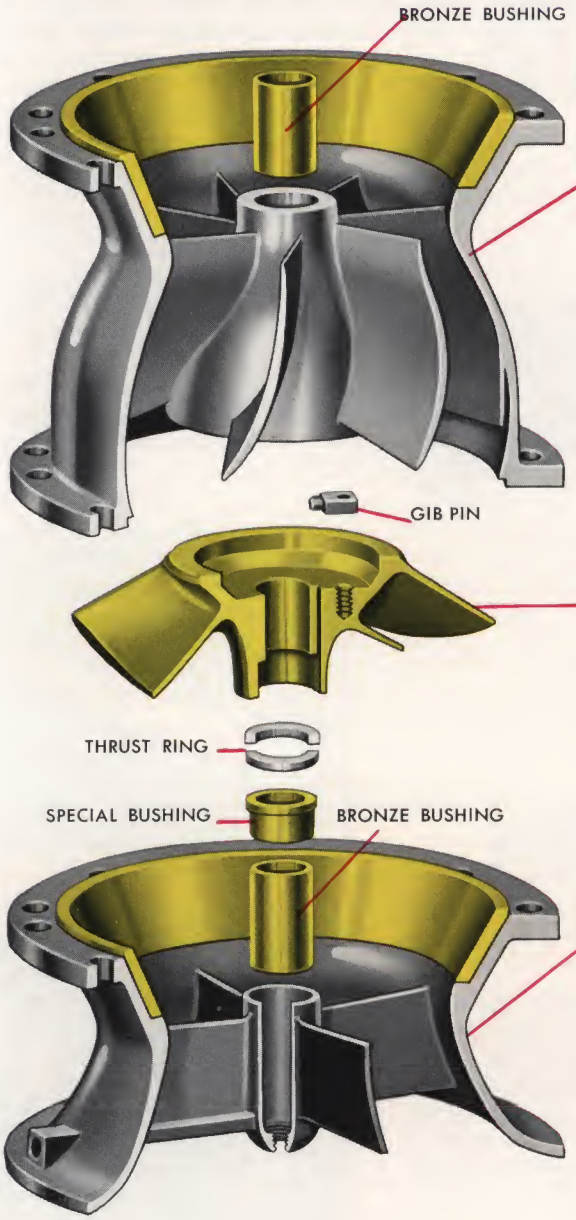
ing the shaft, and internally coupling adjacent sections of the shaft enclosing tubing. They are manufactured from the highest grade of bearing bronze, accurately machined to hardened gages and reamed to a close fit with the line shafting. A spiral groove is machined in each bearing to facilitate positive and uniform flow of oil over its surface and a hole in the wall of each bearing by-passes oil to the next bearing below.

The line shafting is precision turned, ground and polished. The smoothness of operation, characteristic of Peerless pumps, is partly resultant from the combination of precision shafting and close bearing fit.

Water lubricated line shaft is available when specified.

All column flanges are accurately machined and faced after welding to insure perfect alignment.

PUMP BOWL UNIT



BOWL: The pump bowl functions as a diffuser to convert a maximum of the impeller energy into useful pumping head by means of scientifically designed vanes and passages. Standard material is a close-grained cast iron produced in a Peerless foundry by men who are pump casting specialists. Special materials are available for corrosive applications. Extra-length, high quality bronze bearings, support the shaft at both sides of each impeller and labyrinth type sand seals contribute to the traditionally long life common to all Peerless pumps.

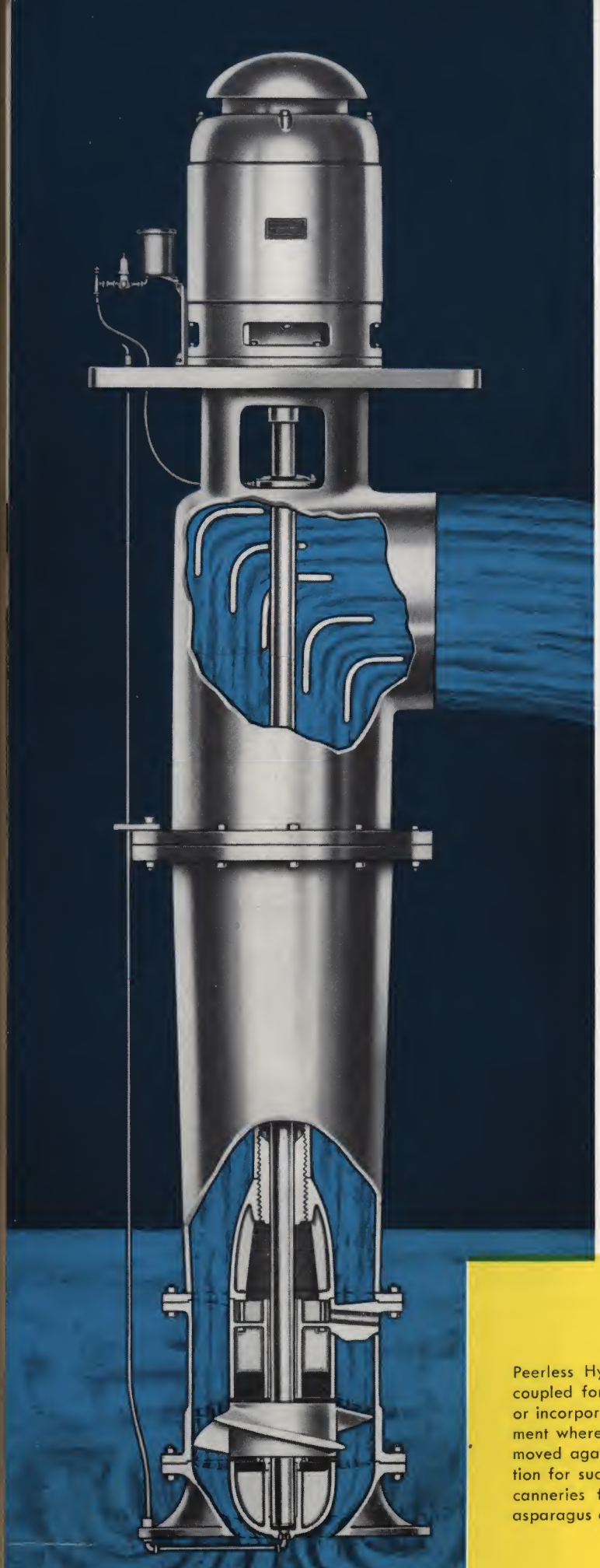
The top bowl of the enclosed oil lubricated line shaft pump is provided with a by-pass port vented to the sump, preventing water under pressure from entering the oil tube. Special seals are available for extreme services. Bronze bowl and suction liners can be furnished when so ordered. For open line shaft water lubricated units, the bowls are equipped with a combination high-quality bronze and fluted rubber bearings. Any line shaft bearings required would have fluted rubber bearings.

Bolted flange connections are used throughout the entire bowl unit and column assembly.

IMPELLER SHAFT: The impellers are rigidly supported and driven by the stainless steel impeller shaft, which is accurately turned, ground and polished from steel having not less than 12% chrome.

IMPELLERS: Impellers are cast of high-grade bronze and are carefully balanced to minimize the unbalanced load on the shaft. Other materials are available for special applications. The cores which produce the water passages in this impeller are made in modern core boxes to further insure balance of the pumping element (not merely as a rotating wheel) and to produce maximum surface smoothness contributing to a direct saving in power cost. The impellers are securely locked and keyed to the shaft and independently retained against thrust forces by a separate thrust ring.

SUCTION MANIFOLD: Housing the lower bearing and encasing the impeller, this important part of the pump has been carefully designed to guide the liquid to the impeller with minimum turbulence, thus aiding in reducing the required submergence of this design of pump. Provision is made to provide grease lubrication to the suction manifold bearing through one of the guide vanes. Abrasives are prevented from entering these bearings by means of a Peerless labyrinth sand seal.



PEERLESS PROPELLER TYPE PUMP

HEAD AND COLUMN CONSTRUCTION

The head and column construction of the Peerless propeller type pump is identical to that used on Peerless mixed flow type pumps and detailed construction features of these parts are given on page 50 of this catalog. Head construction in illustration at left shows a Peerless direct-connected drive embodying a hollow-shaft electric motor.

This type of drive is recommended when electricity is available. Motor driven pumps are widely used because of their remarkable operating efficiencies. All Peerless Pump heads may be used for oil or water lubricated pumps.

BOWL CONSTRUCTION

The pump bowl, of which there can be more than one, incorporating Hydro-Foil guide vane sections, is cast of close-grained iron. The solid, one-piece bronze propeller, also using air-foil design, creates flow in a most efficient and economical manner against a wide variation in lift. All castings are made in a Division foundry which has over 20 years of pump casting experience. The pump bowl shaft consists of turned, ground and polished precision stainless steel, having not less than 12% chrome. For special conditions, bowl parts can be made from materials to best meet individual requirements. Bronze bowl liners can be furnished when so ordered. The suction bell is bolted to the lower flange of the bowl. A diverting cone is cast integral with the suction bell and contains a bronze guide bearing for stabilization of the lower end of the propeller shaft. Sand and abrasives are kept out of this bearing by a labyrinth type sand seal. Propellers are keyed to the shaft and independently retained against the thrust forces by a separate thrust ring.

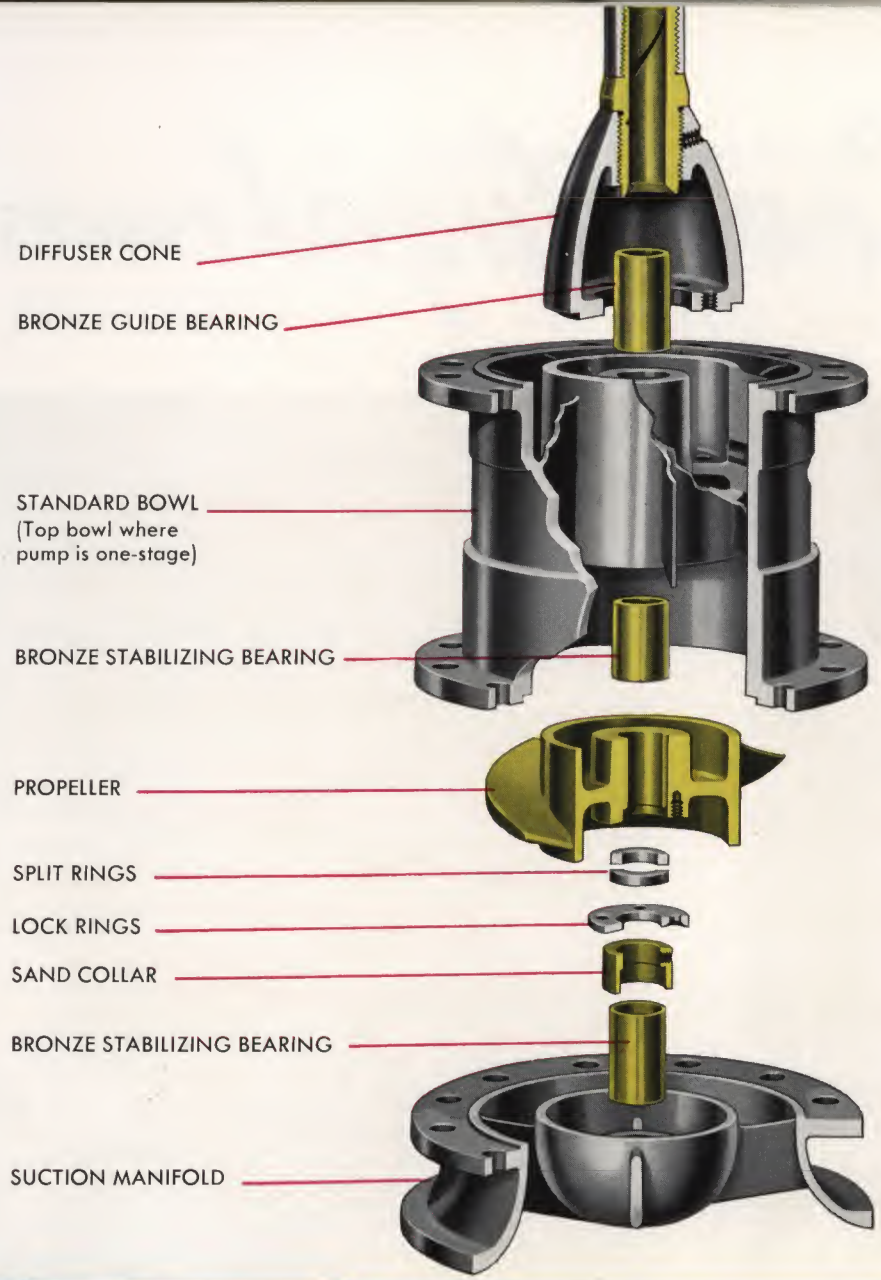
Accurately machined bronze bearings throughout the pump bowl and the suction manifold, as well as the velocity cone on the top of the pump bowl, insure perfect and permanent alignment. All propellers are balanced to minimize bearing duty and are not overhung, but have stabilizing bearings on both sides of the propeller to insure rigidity of the assembly.

Strainers are not recommended excepting when it is absolutely impossible to provide trash racks. Trash racks should be of such design that the trash may be removed during operation of the pump and of sufficiently small bar spacing to prevent larger solids from entering the pump than it is capable of handling.

PEERLESS HYDRO-FOIL PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-148

Peerless Hydro-Foil pumps are often close-coupled for application to pumping systems or incorporated as an integral part in equipment where large volumes of water must be moved against low head. A typical application for such close-coupled pumps is in food canneries for washing vegetables such as asparagus and leafy vegetables.





PEERLESS HYDRO-FOIL PROPELLER TYPE BOWL UNIT

The standard parts and materials of construction of the Peerless propeller-type bowl unit are shown in these drawings at the left. The ruggedness and simplicity which characterize the Peerless propeller-type pump and which contribute to its operational dependability are clearly evident in the illustration. Balanced propeller is amply protected by stabilizing bearings to insure rigidity of assembly. For special services, parts can be made of materials best suited to the intended service. Propeller-type pump may also be obtained with more than one stage.

SUMP DESIGN

The correct application and optimum performance of propeller and mixed flow pumps largely depends upon the proper design of the sump in which the pump is installed.

Peerless pump engineers have done exhaustive studies in the field of sump design, entrance conditions, velocities and pump submergence.

This information, which includes details of proper configurations for sump designs and general recommendations of correct axial-flow and mixed-flow pump application, may be requested from the Peerless Engineering Department.

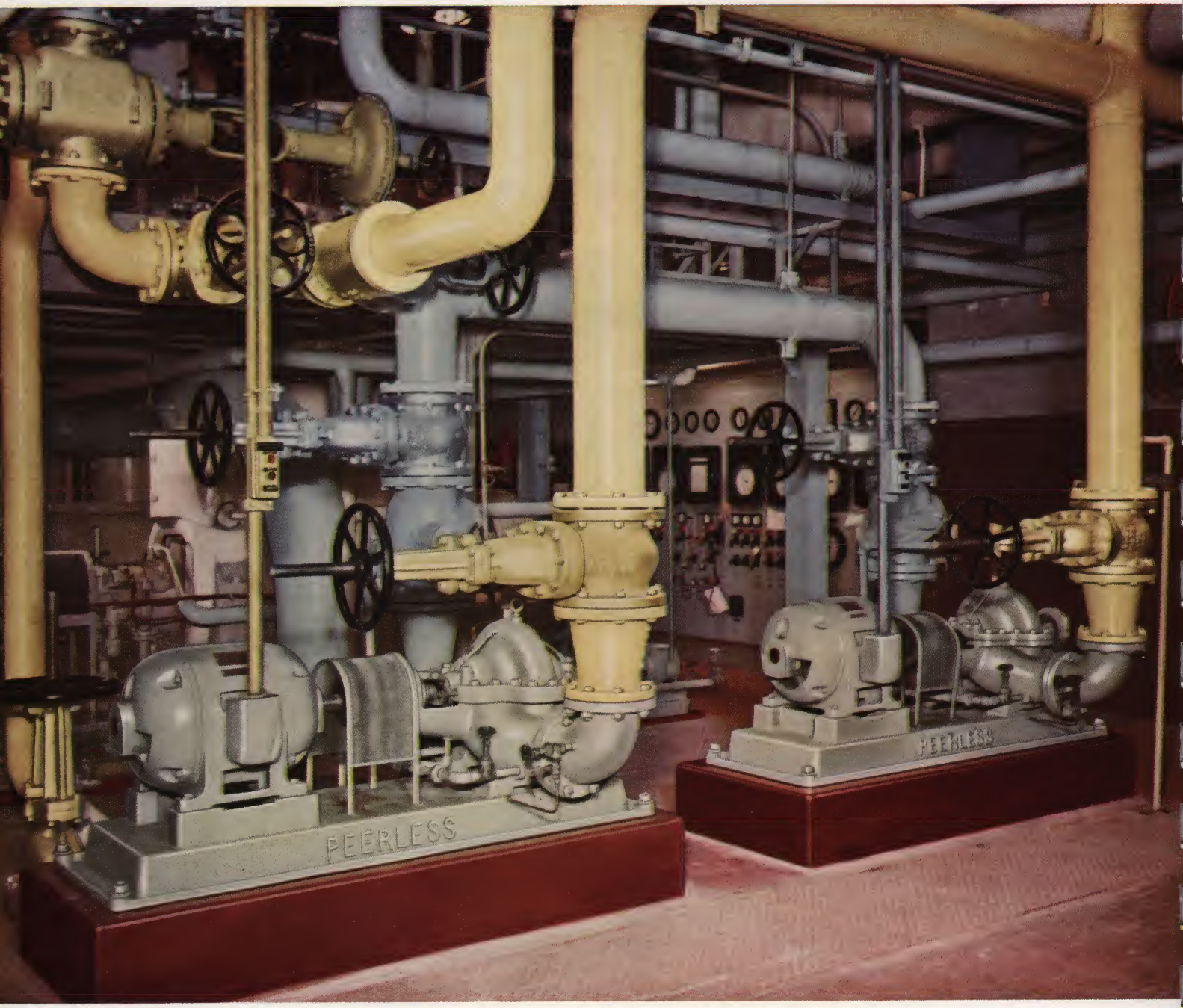




AIR FOIL STREAMLINING: Through concentrated efforts in applying aeronautical streamlining fundamentals to water lift, Peerless has brought greater efficiency to large capacity, propeller type pump construction than normally would be attained.

The difference of water flow in conventional type pump vanes and propellers and the advanced Peerless streamlining principle is illustrated in the diagrams at left and the photograph of the Peerless propeller type impeller above. Power loss and rapid vane deterioration, resulting in inefficiency and increased pumping costs are a natural result of undue water turbulence. The Hydro-Foil design of streamlining pump vanes and blades has succeeded in creating water flow in a more efficient and economical manner. Note particularly how the Peerless propeller incorporates the air-foil streamline in each propeller blade.

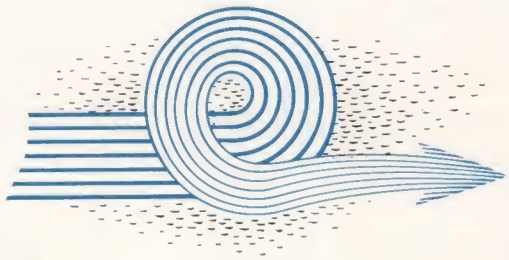
PEERLESS *Centrifugal* PUMPS



THESE PEERLESS TYPE A PUMPS HANDLE WATER USED TO COOL HYDROGEN SURROUNDING GENERATOR FIELDS IN A UTILITY STEAM PLANT.

A COMPREHENSIVE LINE OF HORIZONTAL CENTRIFUGAL PUMPS

FOR GENERAL PURPOSE AND PROCESS SERVICE LIQUID TRANSFER



The Peerless line of horizontal pumps is very complete, as succeeding pages describing and illustrating these pumps will attest. Design-wise, they embody the most advanced principles of hydraulic practice and experience. The same manufacturing skills and application techniques, which have made Peerless turbine pumps leaders in their fields, are constantly applied toward the goal of making each type of Peerless centrifugal pump the leader in its field.

A principal advantage of the centrifugal pump lies in the centralization of the pumping operation within a compact power-driven unit installed in an operationally accessible location. Conversely to the turbine pump described previously, the centrifugal pump does not operate at water or liquid levels below or in the ground so as to force water to the surface. As their name implies, centrifugal pumps employ centrifugal force, generated within a volute, or spiral pump case surrounding the pump impellers, to create a vacuum to move the liquid by suction. While this principle of centrifugal pumping is well understood, the application of it to the pumping of special liquids, of varying specific gravities, viscosities, solids concentration and temperatures, against specific heads or pressures, at determined or variable capacities, under continuous or intermittent duty, enters into a highly specialized field of engineering. Years of design, development and research in hydraulics have enabled Peerless to produce one of the most comprehensive lines of horizontal pumps available from any pump manufacturer. Each pump type is suited to a particular classification of service, and is specifically designed for quality, performance and longevity.

On the following pages are comprehensive descriptions of the pumps comprising the Peerless line of horizontal single and multi-stage pumps. They provide a very complete range of types and models and sizes, from a very broad line of universally applied, general purpose, end-suction, liquid transfer pumps, designated by Peerless as the Fluidyne line, to very specialized lines of chemical plant pumps and refinery process pumps. In between will be found a complete line of general purpose, horizontal splitcase pumps, underwriters' approved single and multi-stage fire pumps, single and multi-stage transfer pumps, several types of vertical chemical and process service pumps, and non-clog waste disposal and sewage pumps.

In addition, brief descriptions are given of Peerless water systems. Peerless water systems comprise a complete line of farm and home pumps for a variety of water-producing services.

Pump users will find that the many pages of engineering data in the back of the catalog will provide extremely useful and practical information not often found so conveniently in one source.

From this descriptive Peerless product data and engineering data, a Peerless horizontal pump can be selected that will move almost any type of liquid in quantities from a tapful to a torrent. Once applied and in service, these Peerless products will prove that **"Peerless builds dependable pumps"** is more than a Peerless slogan—it's a Peerless fact.

CLASSIFYING PEERLESS CENTRIFUGAL PUMPS

Composite charts show application of Peerless centrifugal pumps by broad head and capacity ratings

In its classification of centrifugal pumps Peerless includes single and multi-stage horizontal split case general purpose pumps, single stage vertically split case end-suction general purpose pumps, single and multi-stage, fully approved fire pumps, chemical process and chemical transfer pumps, refinery process pumps and non-clog waste pumps.

To illustrate the general configuration of each of these pump types in the horizontal line, schematic silhouettes are shown at the right. In addition brief descriptions of each pump type afford general application possibilities.

The bar charts below show both relative capacities of each pump type in gallons per minute and the relative heads in feet and pressure in pounds, when pumping water.

From these sketches, descriptions and charts a tentative selection of the Peerless pump type which best fits your application requirements can be made and its description can then be read on the following pages.

GENERAL	MULTI-STAGE
Peerless horizontal split case single-stage pumps are designed especially for general purpose water pumping and liquid transfer. Packing gland (Type A) and mechanical shaft seal construction (Type AS) are available. Capacity range: Type A to 70,000 gpm; Type AS to 750 gpm.	In the Type TU line, Peerless offers horizontal split case multi-stage pumps for a wide variety of liquid transfer and pumping applications. 2-, 3-, 4- and 5-stage pumps are available. The 2-stage pump has low loop cast integral with top case. Other models have high loop. Capacities range up to 3500 gpm.

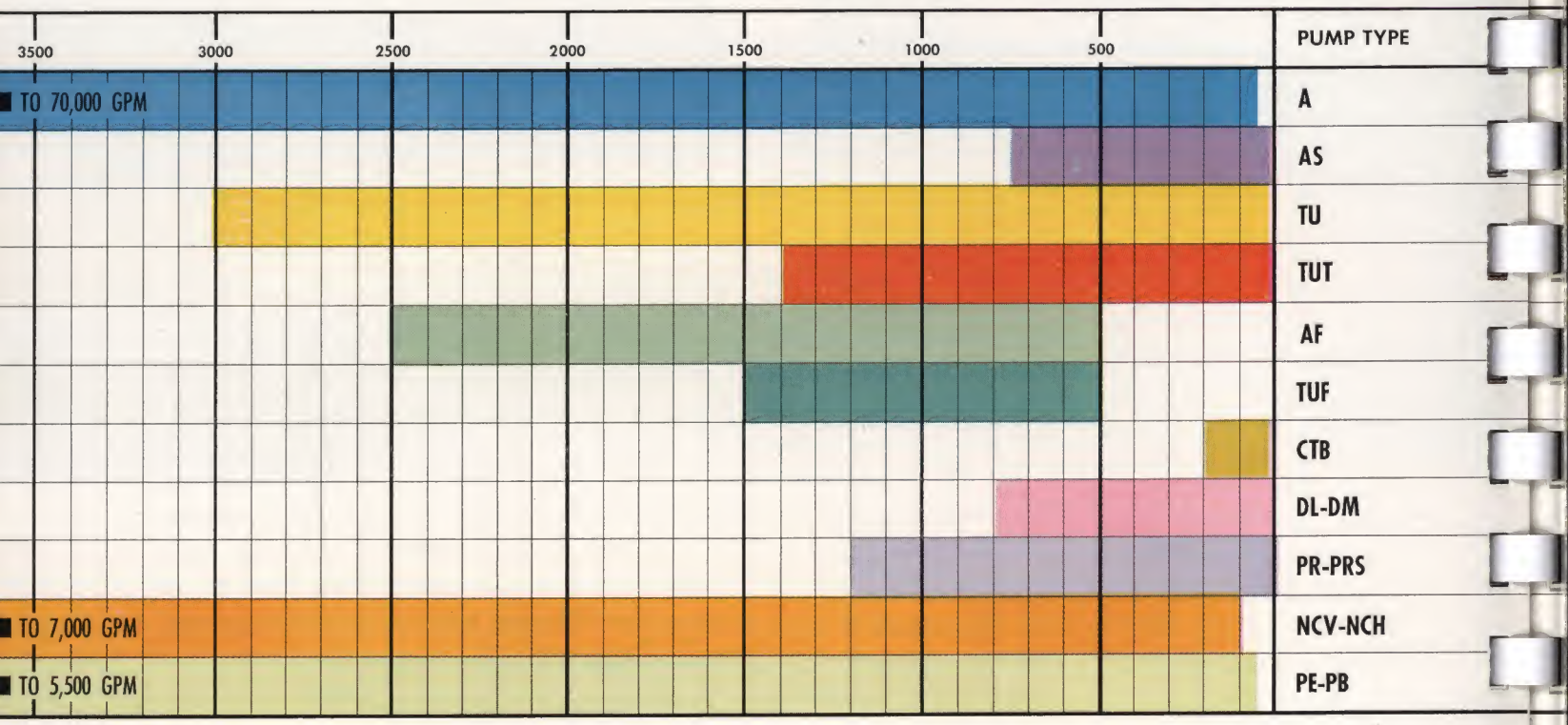








CAPACITIES OF PUMP TYPES IN GALLONS PER MINUTE ←



FIRE

The "standard of the industry" is the way Peerless fire pumps are frequently described. Peerless provides this unsurpassed protection in one of the most comprehensive lines of fire pumps, accessories and fittings offered by any manufacturer. Selections can be made from over 125 models. Fully approved.





CHEMICAL

Complete interchangeability of components is the predominant feature of Peerless Types DL and DM pumps, especially designed for handling chemical process liquids. Both packing gland and mechanical shaft seal construction are available. Wide capacity, head and temperature ranges are offered.





HOT OIL

Peerless Types PR and PRS refinery process pumps are center-line-mount type pumps which are available with packing gland or mechanical shaft seal construction. These are modern, industry-approved pumps for the heavy duty, high temperature pumping required in petroleum and petro-chemicals processing.





WASTE

Both vertical and horizontal dry basin types are available in the Peerless line of non-clog waste disposal pumps. Capacity range of Peerless Types NCV and NCH is from 10 to 7000 gpm and the head range is from 12 to 120 feet.





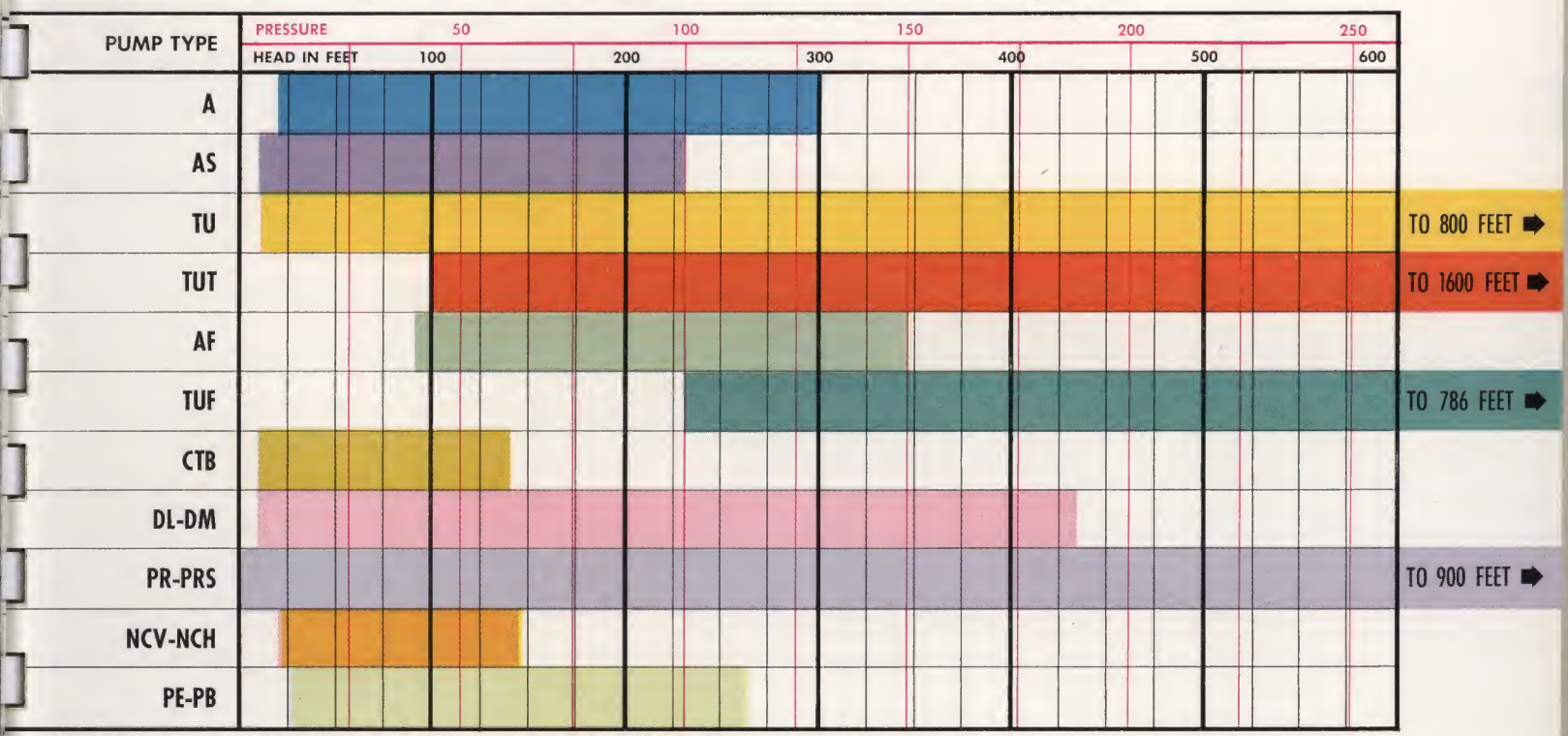
UTILITY

Peerless end-suction type "Fluidyne" pumps are recognized as leaders in sales in their field of general purpose pumping. Superior performance characteristics permit application of these pumps to the broadest variety of applications. A wide capacity range of 10 to 5500 gpm is available.





➡ HEAD (IN FEET) AND PRESSURE (IN POUNDS) *WHEN PUMPING WATER*



THE PEERLESS TYPE A PUMP

SINGLE STAGE HORIZONTAL SPLIT CASE DESIGN

Continuous duty general purpose pumps for pumping water and clear liquids

SIZES	*Double suction: 1¼" through 48" discharge* *Single suction: 2" and 3" discharge*
CAPACITIES	*Up to 70,000 gpm*
HEADS	*Up to 300 ft.*
TEMPERATURES	*Handle liquids up to 200° F.*
DRIVES	*Direct-connected electric motor, flat and V-belt; diesel, natural gas, gasoline engine; steam turbine; combination drives*

In the Type A line of general purpose pumps, Peerless offers one of the broadest lines of pumps capable of handling water and other clear liquids, in quantities up to 70,000 gallons per minute. This pump has a heritage of over 30 years of success in moving clear liquids in almost every kind of industrial, municipal and agricultural application. The Type A pump embodies the most advanced principles of hydraulic practice and experience and will operationally meet or surpass the most exacting requirements for premium pump performance without the necessity of a premium in pump investment.

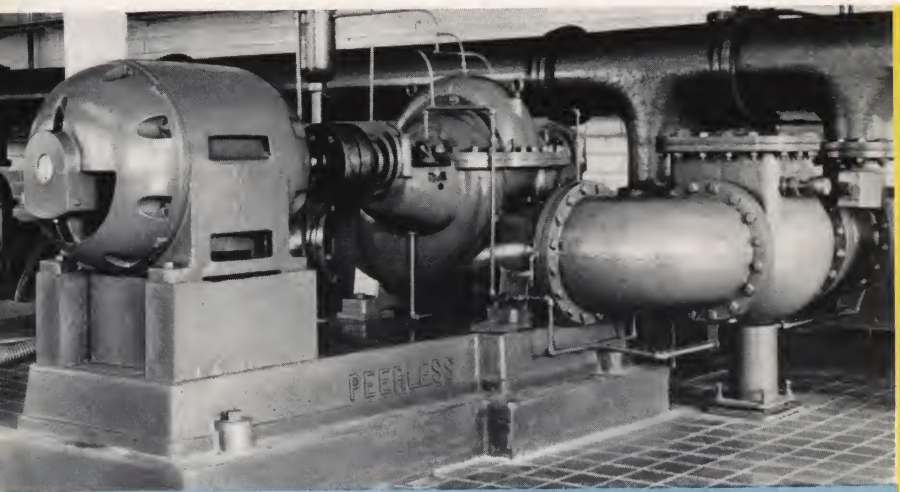
Peerless Type A pumps can be applied to the widest variety of pumping jobs handling water and clear alkaline liquids when there are no solids in suspension. Use of Type A pumps vary from the smallest to the largest applications, from pumping water in a small closed system for engine-cooling jacket water to the largest municipal water supply systems, drainage or irrigation systems.

This line of pumps offers users the widest latitude in capacities, delivering up to 70,000 gpm. Type A characteristics permit pumping against heads up to 300 feet. Liquid temperature up to 200° F. can be handled.

All Type A pumps are high in safety factors. The mechanical design of this line of pumps is superior as is its hydraulic characteristics. Oversize shafts, heavy duty ball bearings, modern design wear rings and shaft sleeves, all contribute to ample protection against wear, afford a high factor of safety in operation and assure reliable service and extended pump life.

Careful attention to every detail of design is amply evident in the Peerless Type A pump. For example, bearing seats are cast and bored integral with the pump case, assuring permanent alignment. All parts are machined to gage on an interchangeable parts system and are rigidly inspected in each phase of manufacturing.

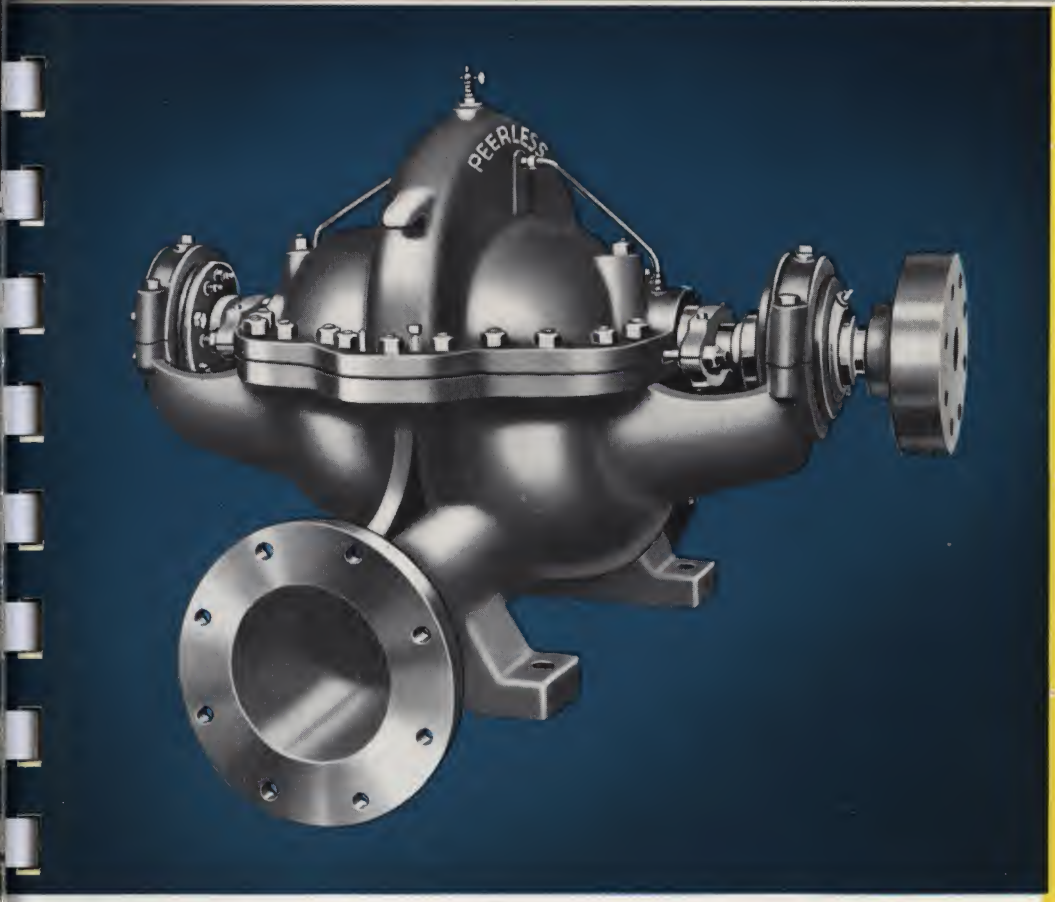
To be doubly sure of meeting or exceeding customers' specifications for performance and efficiency, Type A pumps may be fully tested in the Peerless laboratory, which can duplicate the field conditions under which the pump will operate, prior to installation.



A TEXTILE MILL USES THIS TYPE A PUMP TO PROVIDE PLANT WATER FROM NEARBY SURFACE SOURCE.

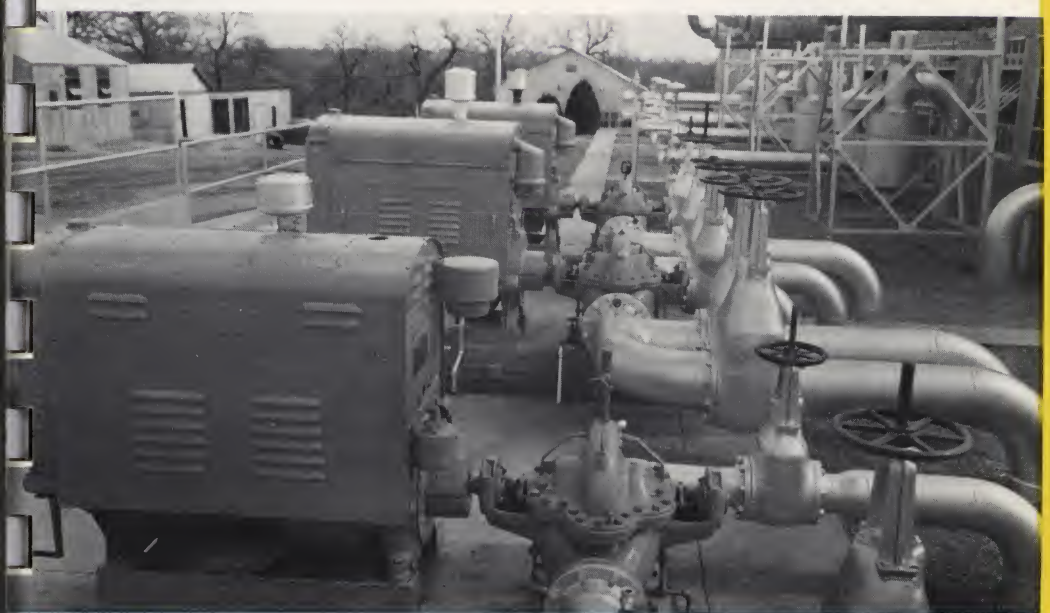
Typical Applications

- WATER WORKS
- FILTRATION PLANTS
- FOOD PACKING PLANTS AND CANNERIES
- COOLING AND REFRIGERATION SERVICE
- CHEMICAL & PROCESS PLANTS
- COAL & METAL MINING
- PETROLEUM REFINERIES
- PAPER MILLS
- IRRIGATION & DRAINAGE
- SUGAR MILLS
- COMMERCIAL BUILDINGS
- TEXTILE MILLS
- POWER GENERATION PLANTS



COUPLINGS The flexible coupling is of the pin and rubber bushing type, having a non-corrosive brass core which fits the pin loosely so that normal axial movement is readily compensated for. Flanges are provided on the coupling halves protecting all projecting nuts. Outer surfaces of the coupling halves are machined to gage.

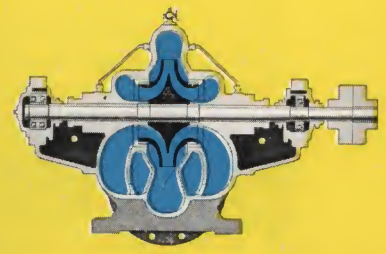
BASE PLATES A substantial cast iron base plate of the box type is made to fit each pumping unit. The pump and driver are carefully aligned and bolted in place at the factory before shipment. On larger sizes sole plates are often furnished to simplify foundation construction.



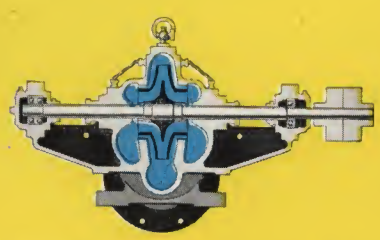
THESE 3 TYPE A PUMPS DRIVEN BY STATIONARY ENGINES ARE IN SERVICE AT A COMPRESSOR STATION.

BASIC TYPES AVAILABLE

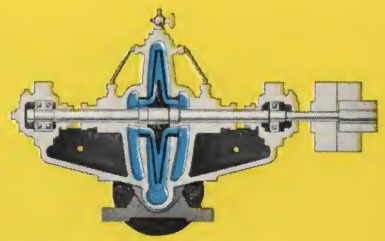
Several basic types of Type A case construction are utilized to meet characteristics of individual applications. The cross sections below indicate varied Type A design to meet such conditions.



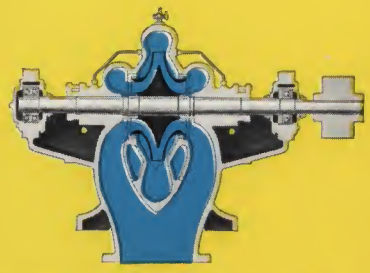
DOUBLE SUCTION impeller design is employed in the balance of the complete Type A line from 1¼" to 48" discharge size.



LOW HEAD. A slight change in case construction is made in certain sizes to meet characteristics of low head conditions.

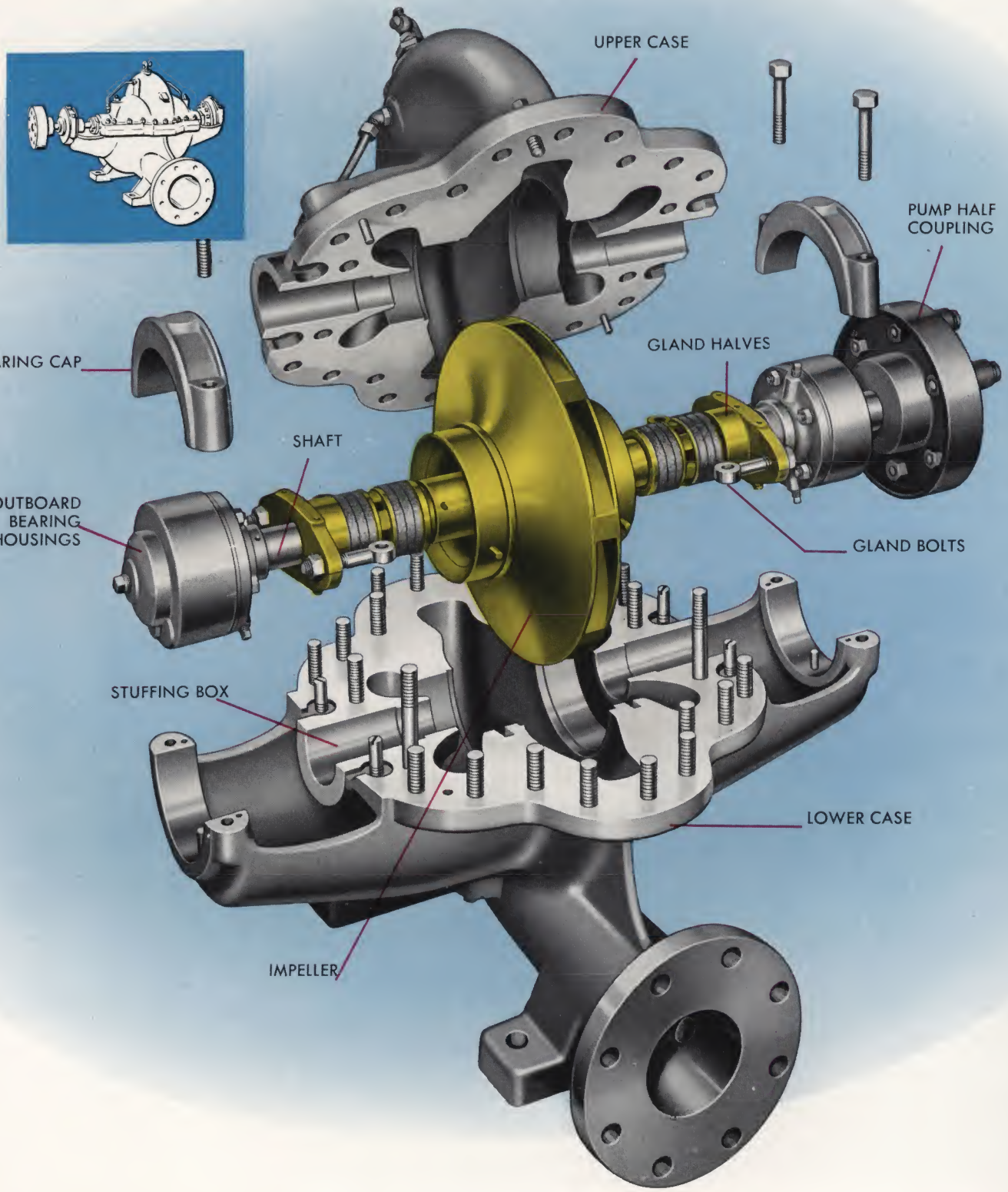


HIGH SPEED. A modification in construction for applicable conditions is the high speed Type A pump Available in 1¼", 1½", 2", 2½" discharge sizes.



BOTTOM SUCTION. The Type A is available in sizes from 12" through 42" discharge size, with bottom suction.

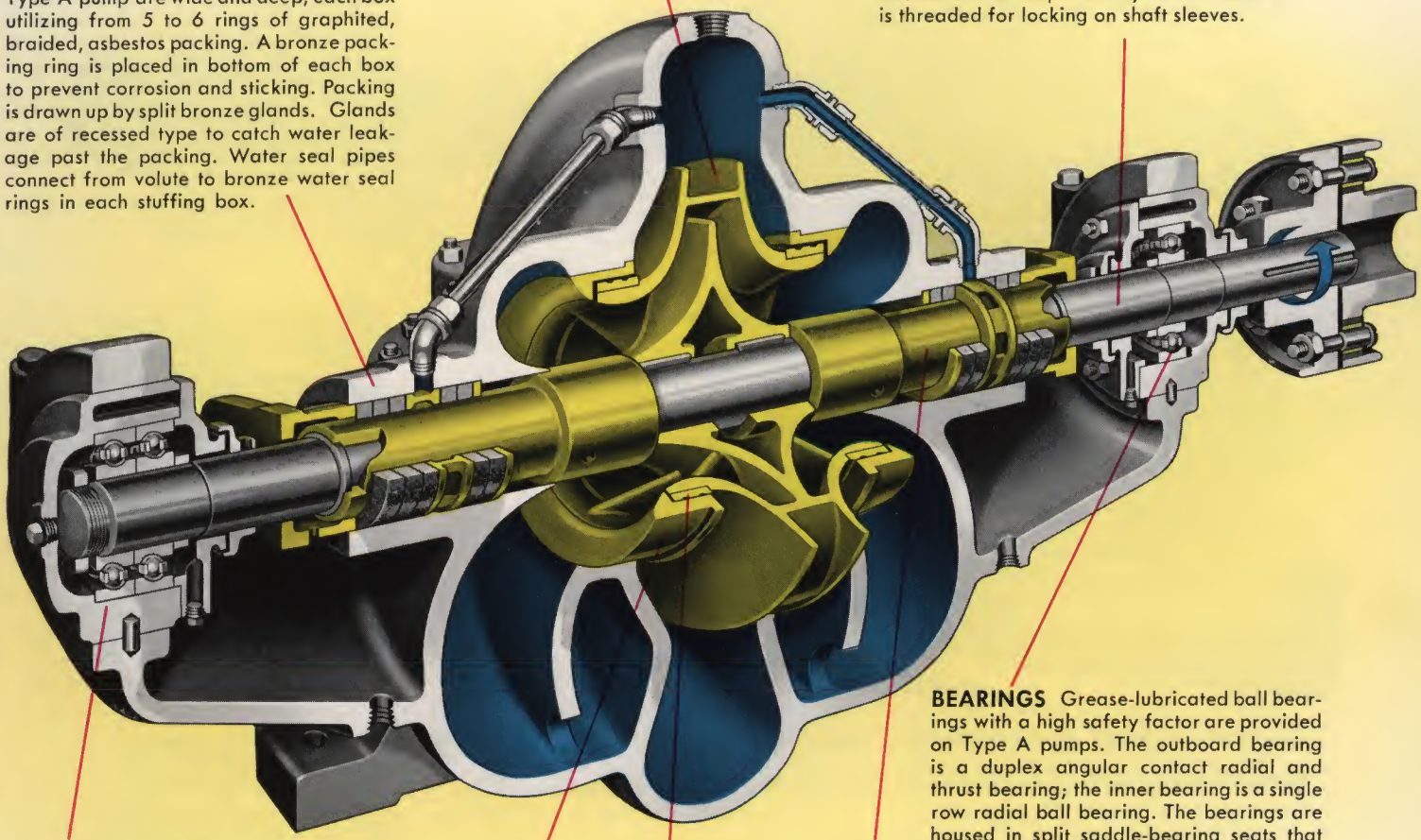
CASE CONSTRUCTION The case of the Peerless Type A pump has been designed for maximum efficiency in operation. It is horizontally split at the center line of the shaft, enabling the upper case and rotating element to be removed without disturbing the pump alignment or piping connections. The upper half of the case is provided with water seal pipe to the stuffing boxes, air vents and lifting eyes. The surfaces between the upper and lower casing halves are machined and provided with a suitable gasket. Drain plugs are provided in the lower half of the case. Water passages through the pump case are scientifically designed for minimum friction loss and turbulence. Regularly made of cast iron the Type A case may be obtained, depending upon requirements, in bronze or other alloys. Type A pumps are of the double-suction design. However, in addition, in three 2″ and 3″ suction sizes where relatively large impeller diameters are involved, single-suction design impellers are employed to facilitate casting the impeller. Bottom suction is available in sizes from 12″ through 42″.



IMPELLERS The heart of a pump is its impeller. In general, all Type A impellers are of enclosed double-suction design. Each impeller is carefully machined outside, hand finished inside, and balanced for maximum accuracy. Double-suction design is employed to insure maximum effectiveness on high-suction lifts and to afford maximum reliability in operation. Impeller is keyed to the shaft for positive driving.

SHAFT Shafts employed in Type A pumps are made of alloyed rolled carbon steel, machined and ground all over accurately to gage. Size of the shafts is determined by maximum torsional load imposed, plus allowance for ample safety factor. Shaft is threaded for locking on shaft sleeves.

STUFFING BOXES Stuffing boxes of the Type A pump are wide and deep, each box utilizing from 5 to 6 rings of graphited, braided, asbestos packing. A bronze packing ring is placed in bottom of each box to prevent corrosion and sticking. Packing is drawn up by split bronze glands. Glands are of recessed type to catch water leakage past the packing. Water seal pipes connect from volute to bronze water seal rings in each stuffing box.



BEARINGS Grease-lubricated ball bearings with a high safety factor are provided on Type A pumps. The outboard bearing is a duplex angular contact radial and thrust bearing; the inner bearing is a single row radial ball bearing. The bearings are housed in split saddle-bearing seats that are cast and bored integral with the lower part of the pump case, assuring permanent alignment.

BEARING HOUSING Bearings are mounted in cylindrical or cartridge type housings. On certain sizes, double-section housings are used with space between inner and outer walls, forming effective water cooling chambers for use when hot liquids are handled. The housings are provided with dust and grease seals and pipe taps for grease injection and drain. Size 30" and above are equipped with babbitt-lined sleeve bearings and ball-thrust bearing.

SHAFT SLEEVES Ample protection against shaft wear is provided by bronze shaft sleeves, screwed on the shaft against the impeller, against the direction of rotation so that they cannot back off. Peerless shaft sleeves are counterbored on the outboard side so that the end of the sleeve may be packed with lead providing a seal against the entrance of air or liquid between the shaft and shaft sleeve. This design permits free expansion of the sleeve when handling hot liquids.

CASE WEAR RINGS The Type A pump case is fitted with single step, angle type bronze wear rings streamlined at entrance to allow free flow of fluid into suction eye of the impeller. The case rings are shouldered against a seat in the casing, providing proper sealing against leakage between the ring and the casing.

IMPELLER WEAR RINGS The secret of Type A efficient operation and low maintenance is the employment of wear rings shrunk on the impeller and fitted to the pump case rings. The type employed in the Type A design are easiest to replace when worn. Experience shows that optimum in wear rings is a flat ring with two or more water-sealing grooves, running with proper clearance. This is the type employed in Peerless Type A pumps. In conjunction with the case wear rings, the impeller wear rings form an effective seal against leakage from the discharge chamber back to the suction.

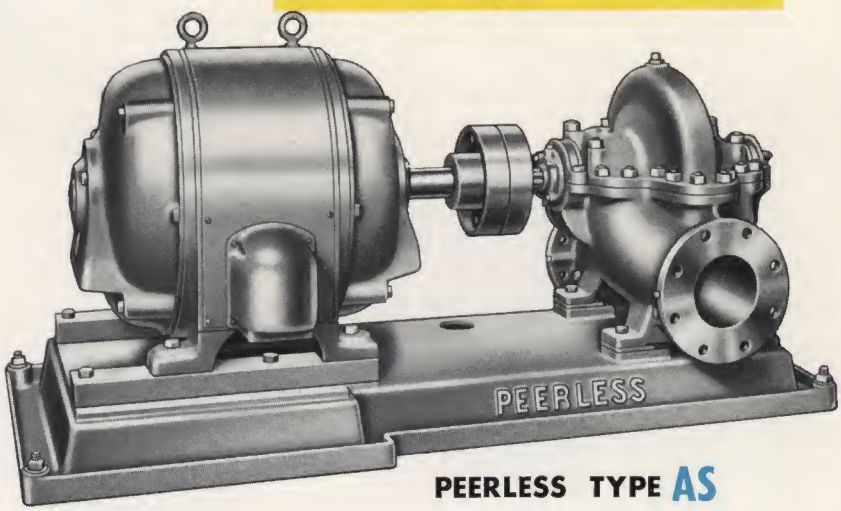
PEERLESS TYPE AS PUMP

GENERAL PURPOSE CENTRIFUGAL

Specifications **GENERAL CHARACTERISTICS**

BALL BEARING
DOUBLE SUCTION
Single stage, horizontal split case design Designed for mechanical shaft seals

DISCHARGE SIZES	*1 1/2 through 4 inches*
CAPACITIES	*Up to 750 gpm*
HEADS	*Up to 230 feet*
DRIVES	*Direct-connected electric motor through flexible coupling. Also gasoline engine or steam turbine drive.*
TEMPERATURES	*Handles liquids up to 200° F.*



PEERLESS TYPE AS

MODERN DESIGN CONSTRUCTION AND PERFORMANCE REFINEMENTS AS PERFECTED BY PEERLESS PUMPS *FEATURING:*

1. **SHORT SHAFT** — The Type AS pump shaft between bearings is approximately one-half the length of conventional pump shafts. Shaft deflection is correspondingly reduced, therefore, pump life is measurably lengthened. Safety factor is multiplied.

2. **LESS FLOOR SPACE USED** — The Type AS pump is about one-half as wide as conventional pumps of same suction and discharge dimensions. Floor space costs money. Here is another measurable saving.

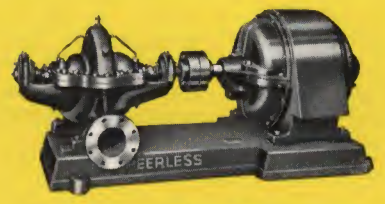
3. **MECHANICAL SEAL** — The Type AS pump is designed for mechanical seals instead of conventional packing. Leaks along shaft are eliminated and downtime for servicing is minimized.

4. **IMPROVED PERFORMANCE** — The Type AS pump scores several points higher in efficiency than conventional pumps of same size. Saves money by doing more pumping with less power.

5. **EASILY SERVICED** — The Type AS pump rotating element lifts out of case in one unit quickly and easily. No special tools required. A minimum of downtime is required for Type AS inspection and maintenance.

PEERLESS TYPE AS PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1350

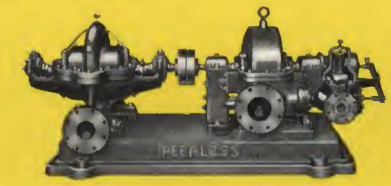
AVAILABLE TYPES OF DRIVE FOR PEERLESS TYPE A PUMPS



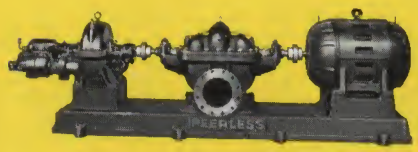
Flexible-coupled to electric motor



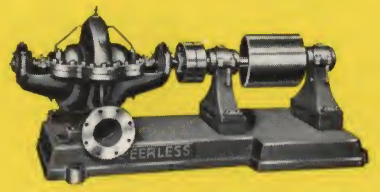
Single motor coupled to dual pumps



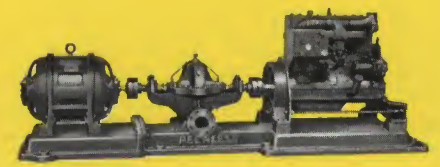
Flexible-coupled to steam turbine



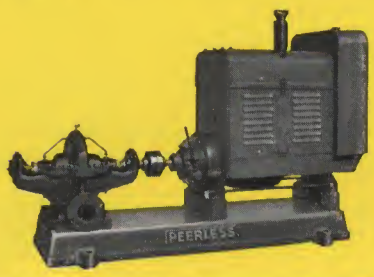
Optional steam turbine or electric drive



Flexible-coupled to flat-belt pulley



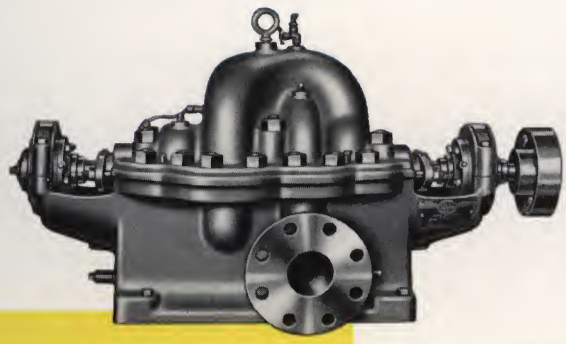
Optional electric or stationary engine drive

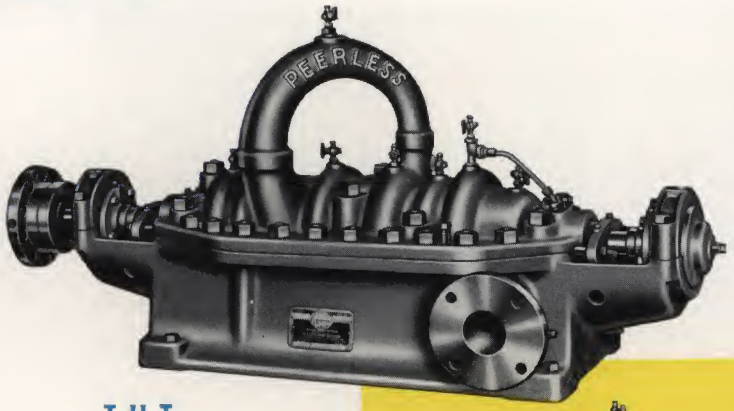


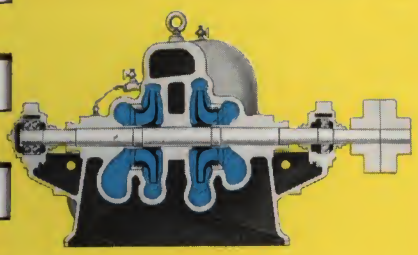
Flexible-coupled to standard gasoline engine

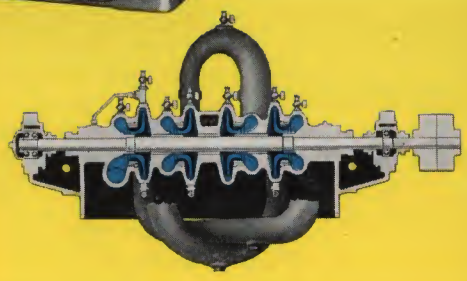
PEERLESS MULTI-STAGE HORIZONTAL CENTRIFUGAL PUMPS

TYPES TU AND TUT *for* GENERAL PUMPING SERVICE AT HEADS ABOVE RANGE OF SINGLE-STAGE PUMPS









	TU Two-Stage	TUT 3-4-5 Stage
SIZES	1½" to 10" discharge	1" to 5" discharge
CAPACITY	Up to 3500 gpm	Up to 1300 gpm
HEADS	Up to 600 ft.	Up to 1600 ft.
DRIVES	Electric and other types	Electric and other types

Peerless Type TU (two-stage) and Type TUT (3, 4, and 5-stage) general purpose horizontal centrifugal pumps are designed to provide maximum efficiency in pumps operating against heads higher than those provided for in single-stage general purpose pumps, described on the preceding pages. The Type TU, single-suction two-stage pump has low loop crossover cast integral with the upper case in sizes through 4". Type TUT, in 3, 4, and 5-stage types, has the high loop. This line of Peerless pumps is ideal for a large number and variety of applications in municipal and industrial use. Excellent efficiencies are inherent in their design. Castings are horizontally split at the center line of the shaft, so that the upper cases and rotating elements can be removed for inspection or repair without disturbing pipe connections.

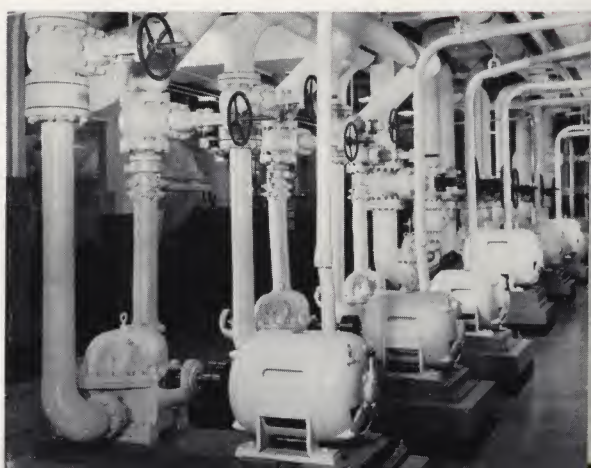
TYPE TU: With an efficiency attained higher than that of two single-stage pumps in series, the two-stage Type TU also has the advantage of a compact self-contained casing which requires minimum space. The case is fitted with water seals, drain plugs and vent cocks for water cooling when handling hot liquids. Cast iron is regularly the construction material, but bronze, steel or other alloys are available when conditions require: consult factory.

TYPE TUT: This single suction 3, 4, or 5-stage pump is offered for heads higher than the Type TU two-stage units. The Type TUT is also a ball bearing, heavy duty, multi-stage pump with impellers mounted to balance hydraulic end thrust as much as possible. Bearing seats are cast and bored integral with the pump case, assuring permanent alignment.

IMPELLERS: The impellers of both Type TU and Type TUT pumps are made of cast bronze in one piece, of the single-suction type, and are machined, hand-filed, polished, and accurately balanced.

STUFFING BOXES are large and deep, each box utilizing five to six rows of graphited, braided, asbestos packing, and a bronze lantern water-seal ring. Water seal piping is supplied for the suction-side stuffing box only, the opposite end box being under the pressure of the first stage only, and therefore, effectively sealed. The discharge side box is tapped, however, for grease lubrication if necessary.

SHAFT is made of steel of high tensile strength, and is machined and ground accurately to size. Oversize shafts provide ample factors of safety.



In this installation a series Peerless Type TU pumps boosts plant process water in a chemical plant.

PEERLESS TYPE TU PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1400

PEERLESS CENTRIFUGAL FIRE PUMPS

TYPES AF AND TUF

For unsurpassed fire protection for every commercial and industrial risk



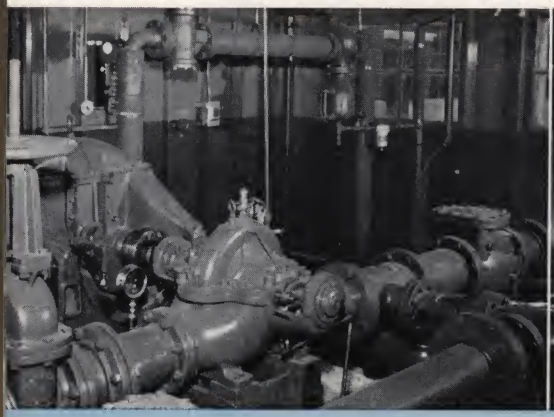
At its Brunswick, Georgia Naval Stores plant, Hercules Powder Co. installed these Peerless fire pumps as part of a system which can deliver 130,000 gallons of foam in 3 minutes for plant protection against spills of benzene and other solvents.

TYPES	TYPE AF—*Single-stage pump* TYPE TUF—*Two-stage pump*
SIZES	TYPE AF, TYPE TUF—*4, 5, 6 and 8-inch discharge*
CAPACITIES AND PRESSURES	TYPE AF—*500 to 2500 gpm at 40 - 150 pounds* TYPE TUF—*500 to 1500 gpm at 100 - 200 pounds*

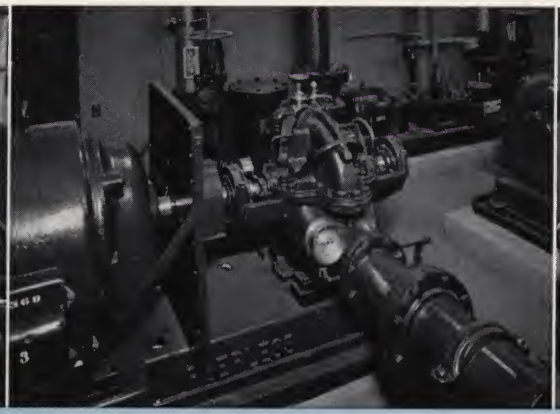
To bring protection against loss by fire to the highest efficiency, an approved and independent fire protection system is a clear business necessity and a reliable and efficient fire pump is the system's vital heart.

Years ago, realizing the need for an advanced yet accepted and proven type of specialized centrifugal fire pump, to complement its line of centrifugal pumps for other purposes, Peerless acquired the facilities of the Dayton-Dowd Company of Quincy, Illinois. Dayton-Dowd-designed fire pumps are pre-eminent in their field. Their acceptance was achieved by an outstanding pump service record over a quarter of a century, during which no Dayton-Dowd pump ever failed to receive approval, or failed to function in an emergency.

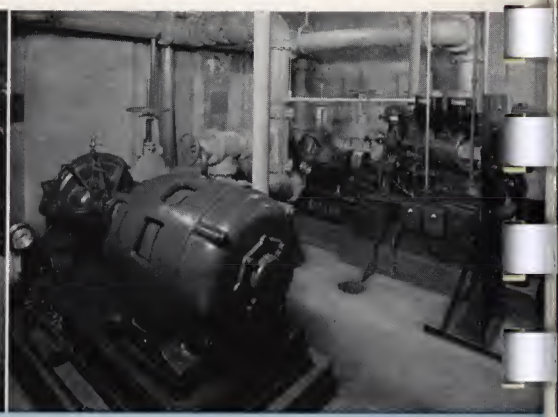
The unsurpassed operative dependability of the Peerless (Dayton-Dowd design) centrifugal fire pump at its present peak of refinement in design and manufacture, results in measurable savings to owners and operators of all types of commercial and industrial businesses. These pumps fully comply with the rigid requirements and regulations of both the National Board of Fire Underwriters, Underwriters' Laboratories, Chicago, and the Inspection Department of the Associated Factory Mutual Fire Insurance Companies of Boston. It is relatively true that each risk pays for a fire pump or sprinkler installation whether it possesses one or not, for fire insurance underwriters' rates are based on 100% perfect installations. Failure to measure up to the high standards demanded subjects the insured to much higher insurance premiums. Thus a first class fire protection plan, centered around a Peerless centrifugal fire pump, effects savings which soon will repay initial equipment cost and return a profit to the owner thereafter. The initial costs of installation of Peerless approved fire protection pumps will be the final costs, made as an investment both in safety and economy.



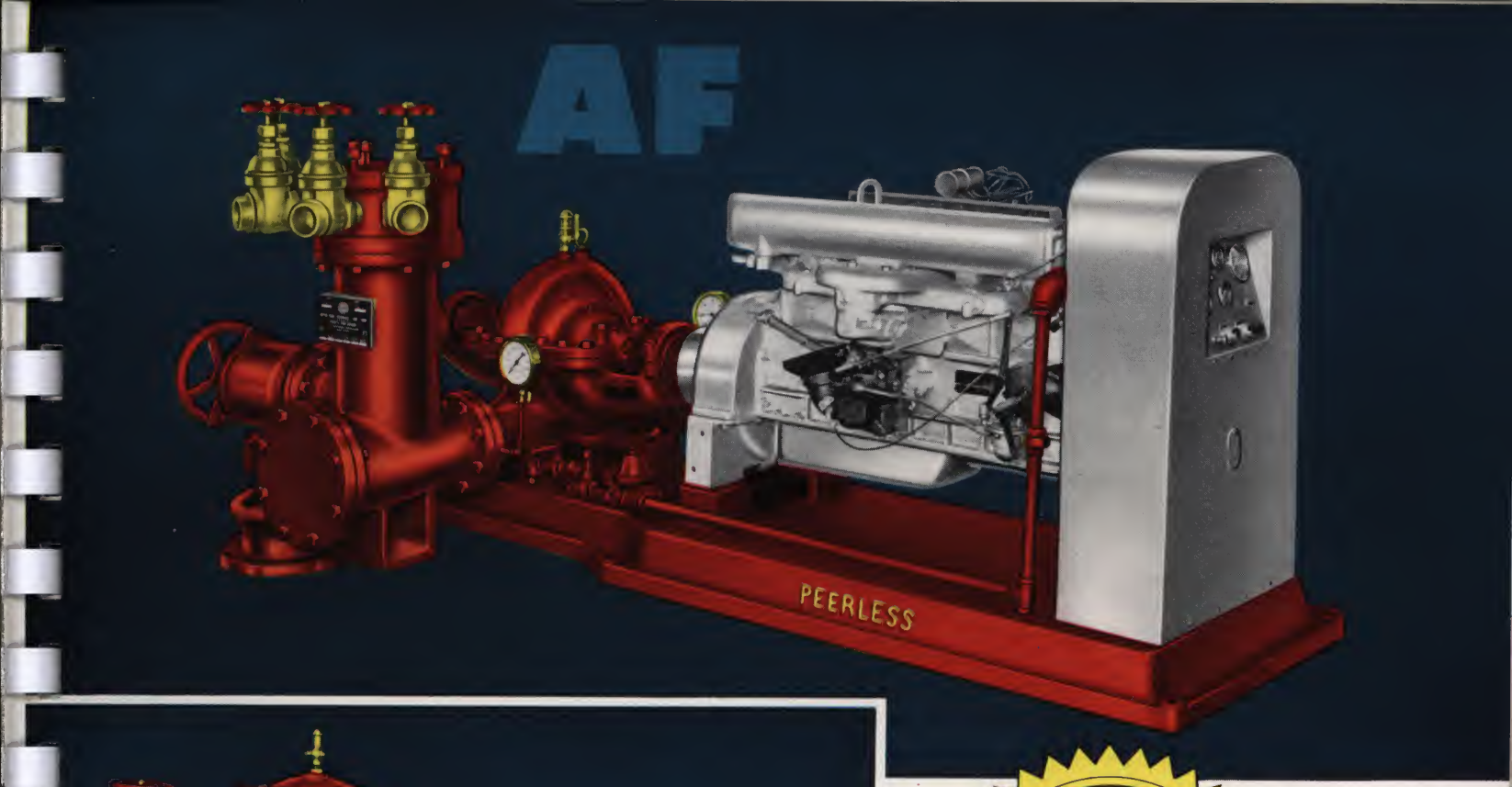
GLASS MANUFACTURER: This steam turbine-driven fire pump is one of three installed in plant of Indiana manufacturer.

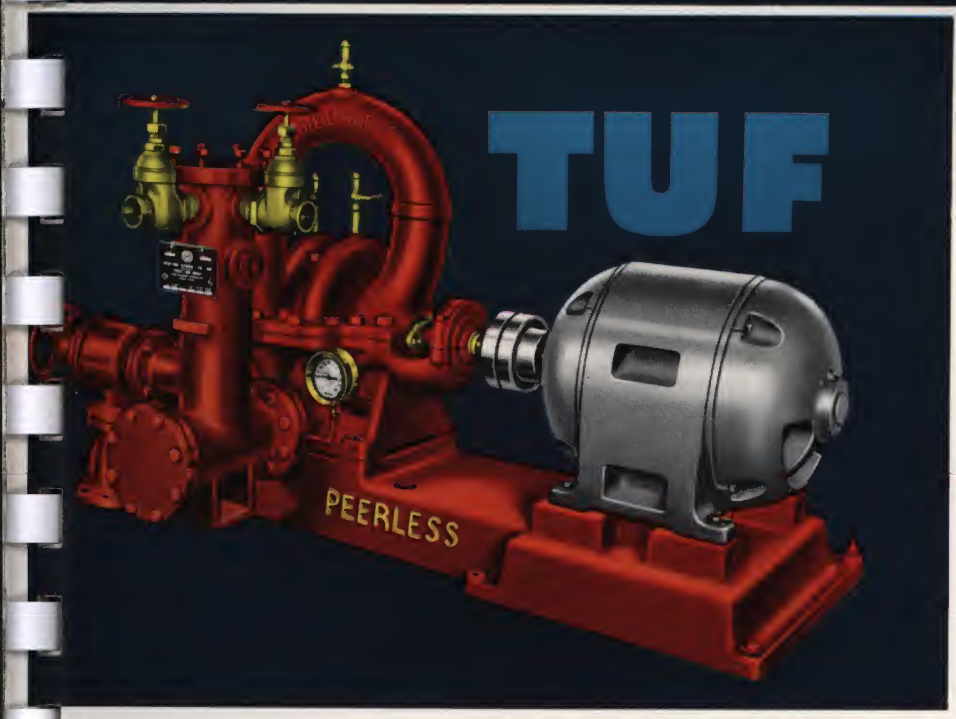


MANUFACTURING: Note use (right rear) of Peerless Type TU jockey pump in conjunction with Type AF Fire pump.



AIRLINE HANGAR: View in a Capital Airlines hangar showing both electric and engine-driven Type AF fire pumps.





FULLY APPROVED
UL
FM
UNDERWRITERS' LABORATORIES INC. AND ASSOCIATED FACTORY MUTUAL FIRE INSURANCE COMPANIES

Peerless Type AF fire pump, as described below, has been fully approved and complies with the rigid requirements of the Underwriters' Laboratories, Inc., and the Inspection Department of the Associated Factory Mutual Fire Insurance Companies.

PEERLESS TYPE AF FIRE PUMP CONSTRUCTION FEATURES

There are two basic types of Peerless horizontal fire pumps. Type AF is the single-stage and Type TUF the two-stage pump. Both types are adaptable to motor, turbine or stationary engine drive and acceptable to the underwriters. The Type AF single-stage pump is available in 4″, 5″, 6″ and 8″ discharge sizes, with a capacity range from 500 to 2500 gpm and with a pressure range, at rated capacities, of from 40 to 150 pounds. Approved types of drives for Type AF pumps include electric motor, steam turbine, gasoline or diesel engines. Peerless Type TUF two-stage pump is also available in 4″, 5″, 6″ and 8″ discharge sizes, but with a capacity range of from 500 to 1500 gpm and with a pressure range, at rated capacities, of from 100 to 200 pounds. Approved types of drives for Type TUF include electric motor, gasoline or diesel engines.

PEERLESS TYPE AF FIRE PUMP

CASE CONSTRUCTION: The case is split at the center line of the shaft, enabling the upper case and rotating element to be removed without disturbing the pump alignment or piping connections. The upper half of the case is provided with water seal pipe to the stuffing boxes, air vents and lifting lugs. Drain plugs are provided in the lower half of the case. Standard construction is cast iron case, bronze fitted. All bronze construction furnished when required.

STUFFING BOXES: Stuffing box construction on the Type AF fire pump is of ample size and depth; each box utilizes 5 rings of square braided, asbestos packing and is equipped with a water seal. Packing is adjusted by split bronze glands. Glands are of recessed type to catch water leakage. Water seal pipes connect from volute to bronze water seal rings in stuffing box.

IMPELLERS: Type AF impellers are of enclosed double-suction design. Each impeller is carefully machined outside, hand-finished inside, and balanced for maximum accuracy. Impeller is keyed to the shaft for positive rotation.

IMPELLER WEARING RINGS: A feature of Type AF efficient operation and low maintenance is the employment of wearing rings shrunk on the impeller and fitted to the pump case-wearing rings. The optimum in wearing rings is a flat ring with two or more water-sealing grooves, running with proper clearance. This is the type employed in Peerless Type AF fire pumps.

CASE WEARING RINGS: The Type AF pump case is fitted with single step, angle-type bronze wearing rings streamlined at entrance to allow free flow of fluid into suction eye of the impeller. The case rings are shouldered against a seat in the casing, providing proper sealing against leakage between the ring and the casing.

SHAFT: Shafts employed in Type AF pumps are made of highest quality alloy steel, machined and ground accurately to gage. Shaft is threaded for locking-on shaft sleeves.

SHAFT SLEEVES: Protection against shaft wear is provided by bronze shaft sleeves, threaded right and left hand against the direction of rotation.

COUPLINGS: The flexible coupling is of the pin and rubber bushing type, having a non-corrosive base core which fits the pin loosely so that normal axial movement is readily compensated for.

BEARINGS: Grease lubricated ball bearings with a high safety factor are provided on Type AF fire pumps. The outboard bearing is a duplex angular contact radial and thrust ball bearing; the inner bearing is a single row radial ball bearing. Bearings are mounted in cylindrical or cartridge-type housing with provisions for watercooling. The bearings are housed in brackets that are cast and bored integral with the lower part of the pump case, assuring permanent alignment.

BASE PLATES: A substantial cast iron base plate of the box type is made to suit each pumping unit. The pump and driver are carefully aligned and bolted in place before shipment.

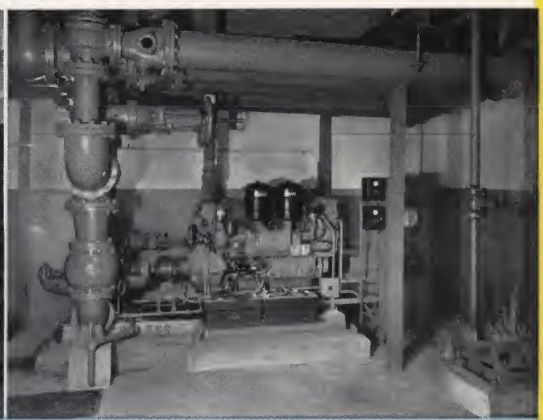
PEERLESS TYPE TUF FIRE PUMP CONSTRUCTION FEATURES

CONSTRUCTION: Peerless two-stage Type TUF underwriters' approved fire pump provides pressure higher than the single-stage pump, plus provision of 100 pounds discharge pressure at 25 and 50 cycle speeds. This type supplements the Type AF design previously described. The Type TUF carries the same ironclad underwriters' approvals as the Type AF.

PEERLESS TYPE AF AND TYPE TUF FIRE PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1500.

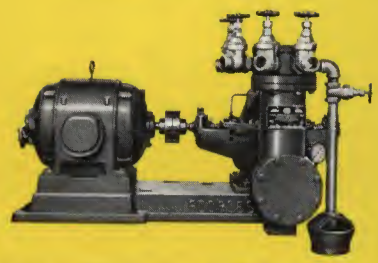


AUTOMOBILE PLANT: Fire pump room shows 3 Type AF pumps—one with Ford Mercury engine drive and 2 with electric drive.

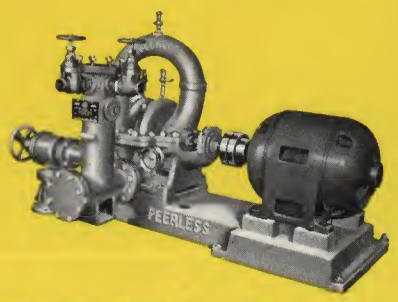


AIRCRAFT HANGAR: American Airlines uses a diesel-driven Type AF pump for fire protection. Note at right use of jockey pump.

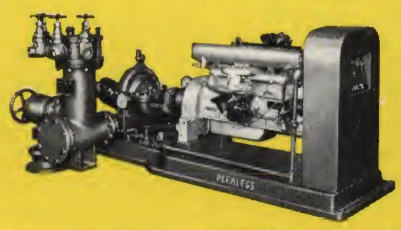
ALL TYPES OF DRIVE



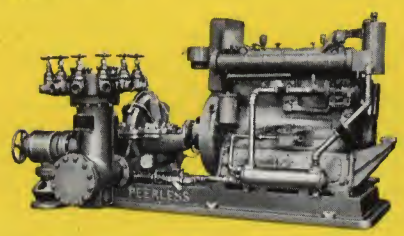
ELECTRIC DRIVE: Type AF fire pump direct-connected to electric motor.



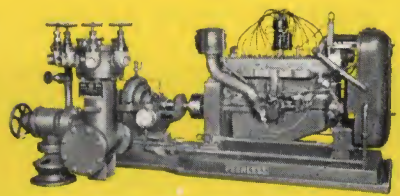
ELECTRIC DRIVE: Type TUF fire pump direct-connected to electric motor.



HEAVY DUTY ENGINE DRIVE: Type AF fire pump with heavy duty gasoline engine drive.



DIESEL DRIVE: Type AF fire pump driven by diesel engine.



ENGINE DRIVE: Type AF fire pump with medium hp gasoline engine drive.

All drives furnished by Peerless with its fire pumps also carry underwriters' approval. Drivers are of nationally known manufacture. Combination drives are also available.

Each fire pump installation varies in its characteristics which must be considered by the inspection department or local board having jurisdiction to assure the adequacy and reliability of the type of power utilized.

TWO-STAGE DESIGN: The Type TUF Peerless fire pump is a ball bearing two-stage unit in one casing, with single-suction impellers mounted in an opposed position, making the pump hydraulically balanced the same as a double-suction pump. The connecting pipe between the stages consists of a loop designed for the most efficient velocity conversion without shock or loss. The pump case is very rugged and heavily bolted. The pump rotor is mounted on heavy duty ball bearings. The bearing seats are cast and bored integral with the pump case, assuring permanent alignment.

The case is protected from wear with single-step, angle-type wearing rings. The shaft is protected from wear in the stuffing boxes by bronze renewable wearing sleeves. The same rigid requirements, prescribed for the Type AF, as to materials, manufacturing specifications and testing, are adhered to in the Peerless Type TUF fire pump.

AUXILIARY EQUIPMENT

HOSE VALVE HEAD: Hose valve heads are furnished in two types, termed inside and outside hose valve heads. There is a third type of fitting which, although it is not termed a hose valve head, performs the same function on low pressure fire pump (under 100 lbs. pressure) applications. It is listed as a concentric discharge increaser. Hose valves are required not only for testing the pump, but in certain installations for actual fire fighting purposes, when the hoses are connected thereto.

BLIND FLANGE: A blind flange is required on fire pump installations to block off either vertical or horizontal discharge opening on the discharge tee. Pumps operating with a suction lift require that this flange be connected to the horizontal discharge opening. Those operating with a suction head ordinarily have this flange connected to the vertical discharge opening, either on the inside type hose valve head if used, or directly on the discharge tee.

ECCENTRIC SUCTION REDUCER: NBFU standards require that provision shall be made in the pump casing, or by castings bolted to the pump casing, to bring the pump suction to the sizes listed below.

Pump (GPM)	500	750	1000	1500	2000	2500
Suction inlet	6″	8″	8″	10″	10″	12″

OVERFLOW CONE: NBFU standards require that overflow cones shall be so constructed that the pump operator can easily see any water wasting through the relief valve or test valve whichever the case may be.

HOSE VALVE: NBFU standards require that approved 2½″ hose valves of the number specified below shall be provided:

Pump (GPM)	500	750	1000	1500-2000	2500
No. of Hose Valves	2	3	4	6	8

CONCENTRIC DISCHARGE INCREASERS: Discharge increasers are furnished, according to NBFU standards to bring the pump discharge openings to the sizes listed below:

Pump (GPM)	500	750	1000	1500	2000	2500
Discharge Outlet	6″	8″	8″	10″	10″	12″

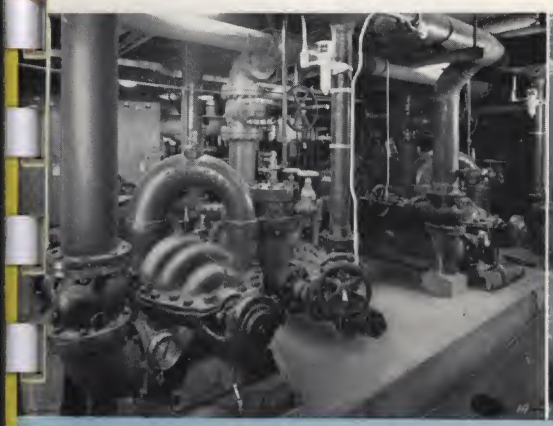
On low-pressure fire pump application where a discharge tee is not normally required, concentric discharge increasers are supplied to comply with the above standards.

AIR CHAMBER: On automatically controlled low-pressure pumps (under 100 lbs.) an air chamber is furnished to be placed in the discharge line to provide air connection to the automatic control panel.

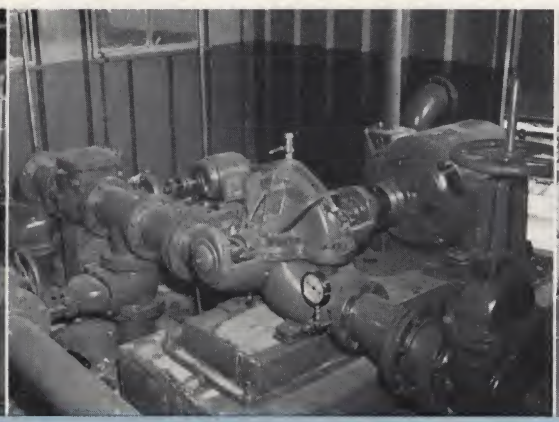
TANK FILLING PUMPS: For tank filling service, Peerless makes available several types of approved pumps. Peerless sales engineers can furnish proper application information for this service.

JOCKEY PUMPS: The term "jockey pump" refers to a pump generally installed on automatic sprinkler systems. Its function is to keep pressure on the line at all times. It shuts off when the desired pressure on the system is obtained.

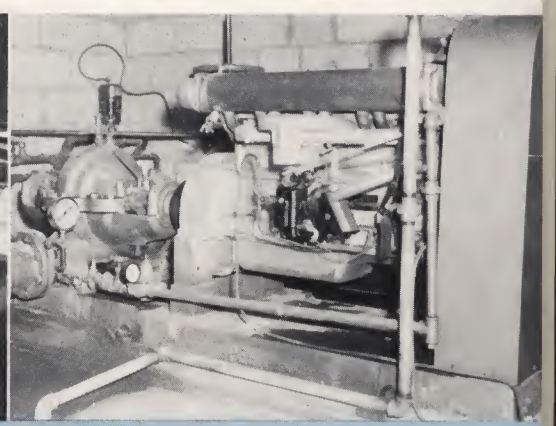
Peerless furnishes several types of pumps for this service, selection based upon individual job requirements. These include the Peerless Type A pump described on page 58, the Peerless Type PE pump described on page 74 and the Peerless Type TU pump described on page 63.



DEPARTMENT STORE: Two Type TUF two-stage fire pumps installed for a Midwest department store.

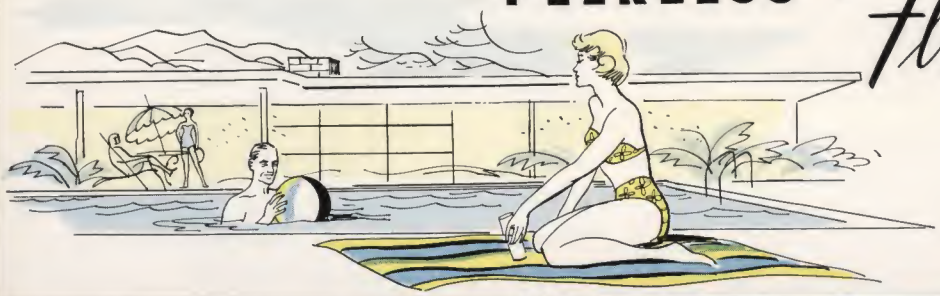


MANUFACTURING: Motor-driven Type AF pump, rated at 1000 gpm against 100 pounds pressure, is installed in rubber products plant.



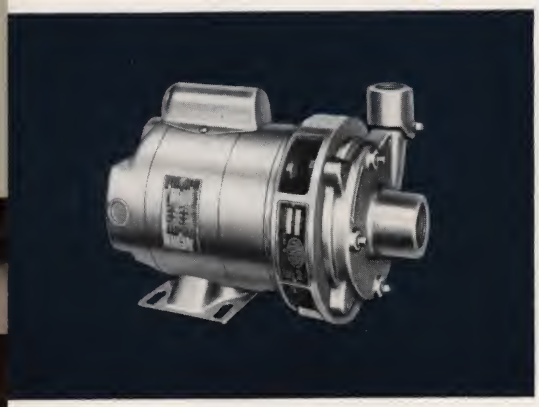
APPLIANCE MANUFACTURER: Type AF fire pump, driven by Chrysler engine, in service for washing machine manufacturer.

PEERLESS *Fluidyne*®

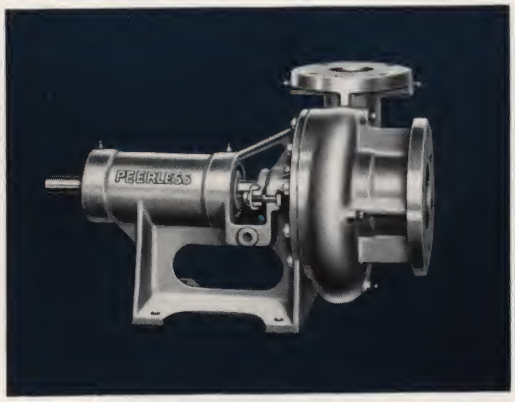


ECONOMICAL GENERAL PURPOSE PUMPS

TYPES
PE
PB
PS
PN
ESP
BSP



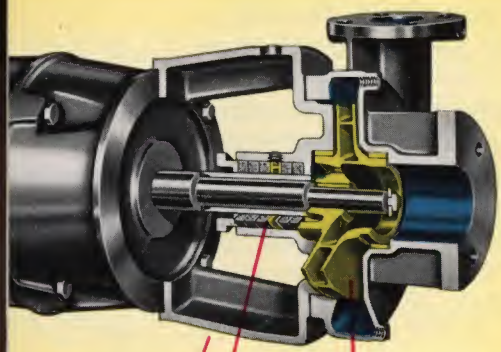
Type PE Fluidyne face mount fractional hp electric drive with threaded connections.



Type PE Fluidyne close coupled integral hp electric drive with flanged connections.

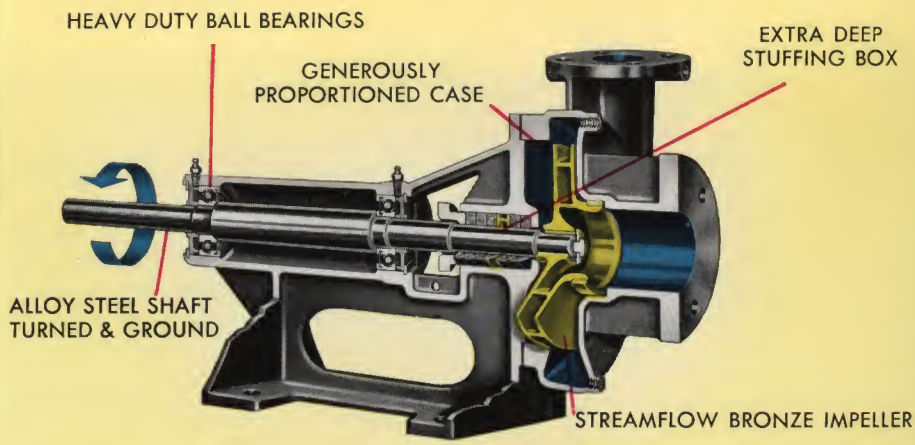


Type PS sprinkler irrigation pump; one of a complete line of trailer and skid mounted engine driven pumps offered by Peerless to provide dependable water supply for overhead irrigation.



CUTAWAY VIEW PEERLESS TYPE PE PUMP

From one of the broadest lines of general purpose pumps offered by any manufacturer of pumping equipment, Peerless provides, in the Fluidyne line of single stage end-suction horizontal centrifugal pumps, a pump that can be usefully, economically and efficiently applied to almost every commercial, industrial and agricultural service. Correct application of Peerless Fluidyne pumps provides positive and con-



CUTAWAY VIEW PEERLESS TYPE PB PUMP

tinuous pumping of water and other liquids for factories, food processing plants, commercial buildings, commercial water supply systems, sprinkler irrigation systems as well as for system assemblies such as air-conditioning.

Fractional horsepower models Type PE and PB provide a range of sizes from ¼ to 1½ hp, with capacities up to 65 gpm and heads to 110 feet.

Integral horsepower models Types PE and PB provide a range of sizes from 1 to 150 hp with capacities up to 5500 gpm and heads to 260 feet. Within the line, impellers and volutes are interchangeable, on identical sizes, between the Types PE and PB permitting a simplified stocking of pump parts when the two types are used. Type PS pumps are applied to sprinkler irrigation service. A complete line is available. The Peerless Type PN pump is for applications to air conditioning, refrigeration and heating systems. The Type ESP and BSP pumps are especially suited to applications where a self-priming pump is required. Use of standard horizontal pump motors allows quick motor change without dangerous delay or costly inconvenience. Mechanical shaft seals are standard on many models. Packing gland construction is standard on most integral hp models, but these pumps can be equipped with a mechanical shaft seal if required. Here are other features of the Fluidyne line:

ECONOMY Designed with economy in mind; economy in first cost, installation, maintenance and operation—all without compromise of quality.

DURABILITY Every consideration has been given in design and construction to assure long service life even under abnormal service and rough usage.

EFFICIENCY In all sizes, types and models the Fluidyne line is characterized by high efficiency ratings, providing high performance at low cost.

VERSATILITY Indoors or out, every general utility pumping service can use Peerless Fluidyne pumps. Their application is almost universal.

COMPACTNESS Space costs money; Fluidyne pumps fit neatly into both piping and pumping layouts as well as into system sub-assemblies.

EASILY MAINTAINED No special drills or special tools are required to perform ordinary pump maintenance on pumps in the Fluidyne line.

DEPENDABILITY Ample safety factors assure dependable performance on continuous or intermittent duty, regardless of mounting angle.

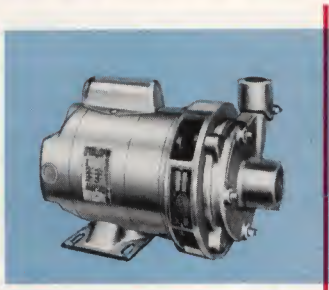
GOOD LOOKING Pleasing, trim and compact, their sturdy exterior design makes for neat installations.

HYDRAULICALLY CORRECT Peerless impeller and volute design assure non-pulsating, non-turbulent liquid flow.

Select a pump in the Fluidyne line with the confidence that it will provide the most efficient pump for the intended service at the lowest cost, with assurance of ample safety factor in either continuous or intermittent duty.

PEERLESS FLUIDYNE PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-2300

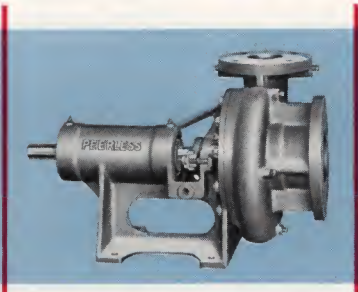
END SUCTION TYPE PUMPS FOR GENERAL PURPOSE APPLICATION



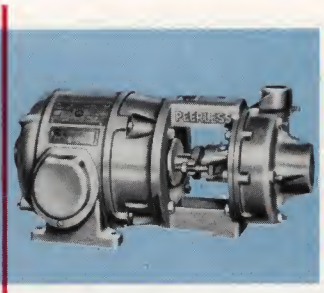
TYPE PE-A—Motor sizes: ¼-1½ hp. Facemount design new NEMA type motor. Compact, efficient, shaft seal equipped.



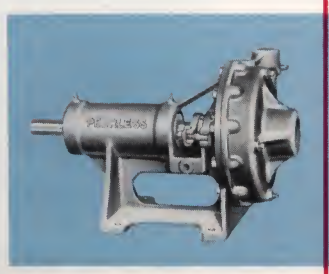
TYPE PE-200—Motor sizes: 2, 3, 5, 7½ hp. Economical, compact. Facemount design. Versatile, good looking. Shaft seal equipped.



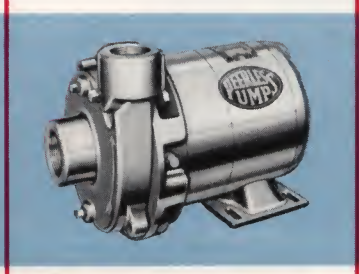
TYPE PB—Heavy duty end-suction design with flanged connections for applications with connections above 2½" size. Rugged; durable.



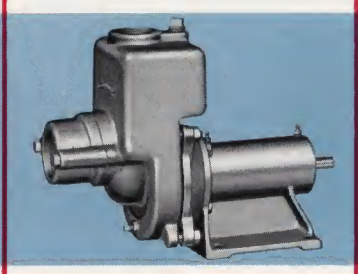
TYPE PE—Motor sizes: 1 to 40 hp. Capacities: Up to 800 gpm. Heads: Up to 260 feet. Compact, efficient, versatile, dependable.



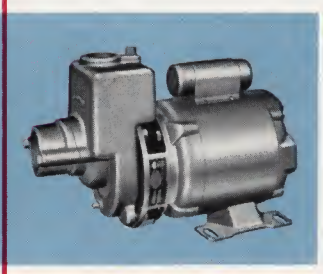
TYPE PB—Motor sizes: 1 to 150 hp. Capacities: Up to 5500 gpm. Heads: Up to 260 feet. A type, size and model for almost every water handling job.



TYPE PN—Motor sizes: ¼, ⅓, ½, 2 hp. Low head pumping. Shaft seal equipped. New facemount NEMA type motor.

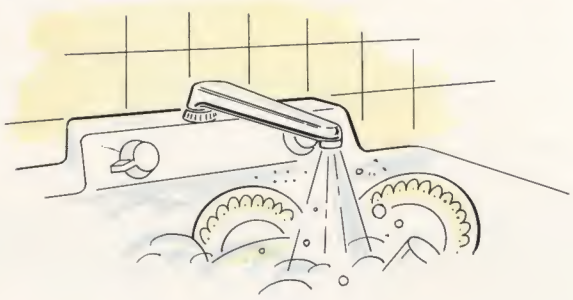


TYPE BSP—Motor size: ¾ hp. Close coupled, self-priming pump. Excellently suited to high capacity pumping.



TYPE ESP—Motor sizes: ½, ¾, 1 hp. For high head, low capacity service. Self-priming. For tank, sump and pool service.

PEERLESS WATER SUPPLY SYSTEMS



The installation of a Peerless pressure water system can bring city-conveniences to every home or cabin, farm or ranch, resort or commercial business located beyond city water mains.

The modern Peerless water system is trouble-free, quiet running and fully automatic. It will run right through the seasons without a worry. Each Peerless pressure water system is easy to buy, install, operate, inspect, and maintain.

Included in the Peerless water system line are jet systems of all types. Peerless offers scores of models of single and multi-stage designs as well as models which are convertible from shallow to deep well operation when future water requirements dictate. In addition Peerless features submersible pumps and the Peerless Dynaflo®, a submersible pump with a unique pumping element that literally squeezes water uphill without the use of jets, impellers or rods. The same type of pumping element is also employed by Peerless in its famous and widely accepted Water King shallow well pump. Just as in its other pump lines, Peerless reputation for outstanding dependability, performance and economy is readily apparent in its pressure water system lines.

The plant in which Peerless water systems are produced is a model of present-day straight line production. No expense has been spared to provide tooling that will insure the most accurately machined systems possible. Elaborate testing facilities assure that each system will meet or exceed its mechanical and hydraulic standards.

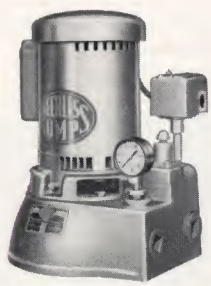
Peerless pressure water systems are sold through the U.S. and in many foreign countries by a capable and reliable water system dealer organization. In most areas a Peerless dealer will be found who can correctly apply, install and service a Peerless pressure system for the water capacity and pressure desired. Because of the wide number of pump types, and scores of models within these types, Peerless provides the widest selection of pumps to exactly meet almost every system head and capacity condition.

Peerless dealers are supervised in their application and after sale service by Peerless sales engineering personnel located in



JET SYSTEMS

MANY TYPES, SCORES OF MODELS AND A WIDE RANGE OF PRICES TO CHOOSE FROM



SINGLE STAGE DEEP WELL JET SYSTEMS

Available for deep or shallow well over-well or offset installation. New, improved models provide water capacities up to 3600 gallons per hour for wells up to 170 feet deep. Motor sizes range from ¼ to 3 hp.



THE WATER KING. This positive-flo pump is the quietest running system of all pressure water systems. Shown here, it is mounted on a 12 gallon tank. It will produce up to 800 gallons per hour from shallow wells and cisterns. Operates at half usual pump speed for long lived economy. Always in prime.

Peerless district and branch offices. All personnel in these offices are factory-trained. They work constantly with Peerless dealers so that Peerless water systems owners are assured of proper system selection, application and service.

The population trend from urban centralization to suburban development has increased Peerless' responsibilities in this field of pressure water development. From the very comprehensive line of pressure water pumps and systems, there can be selected exactly the right pump to provide all the pressure water for all domestic and commercial establishments beyond city water mains. Yes, you can buy and apply a Peerless pressure system with confidence in its dependability as well as in the fine Peerless dealer organization who will back up its installation with superb after-sales service.



DYNAFLO® SUBMERSIBLE PUMP

This is the modern design in the popular submersible pump. It's "the pump that's different." Unique pumping element literally squeezes water uphill, without impellers, rods, jets or gadgets. Apply it to wells up to 400 feet deep, for capacities up to 1680 gallons per hour. ½ to 1½ hp motor sizes available.



DYNAMATIC SUBMERSIBLE PUMP

Peerless quality centrifugal type submersible pump. A completely automatic water system with everything in a package ready to run. Developed and proved in many years of actual service. For application to wells up to 440 feet in depth and for water capacities up to 2010 gallons per hour from shallower settings.

PEERLESS WATER SYSTEMS ARE COMPLETELY DESCRIBED IN INDIVIDUAL PRODUCT BULLETINS. REQUEST BULLETINS ON EACH TYPE BY PUMP NAME. DEALERSHIPS ARE AVAILABLE IN SELECTED AREAS. WRITE FOR COMPLETE DETAILS, PRICES, DISCOUNTS, ETC.



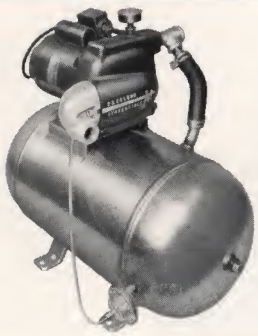
MULTI-STAGE JETS

Powerful water producers for both deep and shallow well installations. Capacities: up to 3200 gallons per hour from shallow wells and up to 2180 gallons per hour from deep wells.



CONVERTIBLE DEEP WELL JET

A very compact pumping unit. Pumps up to 840 gallons per hour. Four to 42 gallon tanks available.



CONVERTIBLE SHALLOW WELL JET

Tank mounted pump converts to deep well use when required. Can provide up to 1000 gallons per hour when installed in shallow wells.



SUPER 500 JET

A popular Peerless pump at a popular price. ½ hp system that provides up to 740 gph from shallow wells or 690 gph from deep wells.

PEERLESS NON-CLOG WASTE PUMPS

VERTICAL and HORIZONTAL DRY BASIN TYPES FOR SEWERAGE AND INDUSTRIAL WASTES

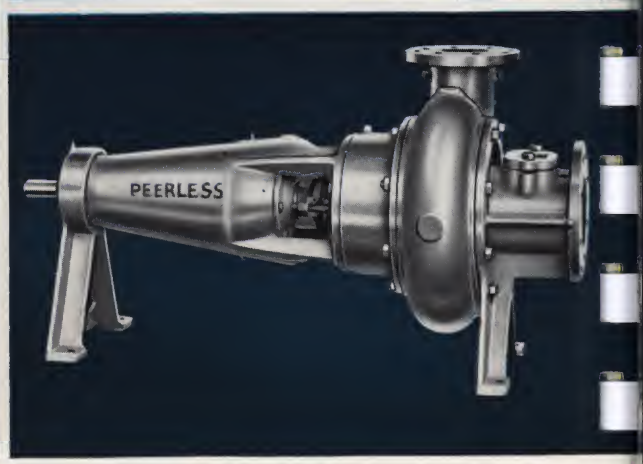
NCV
NCH

Especially designed for service in sewage disposal plants, paper and food processing plants, fish canneries and other industries where disposal of wastes and solids in suspension is a problem.

CAPACITY	*up to 7000 gpm*
LIFTS	*12 to 120 feet*
MOTOR SIZES	*1 to 100 hp*
DRIVES	*Electric and other types*



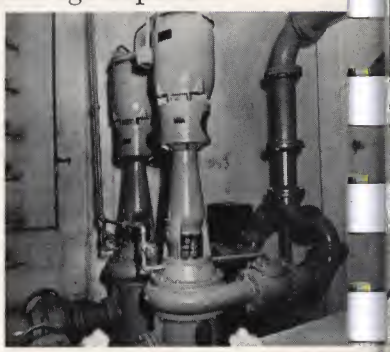
Type NCV Vertical Waste Pump.



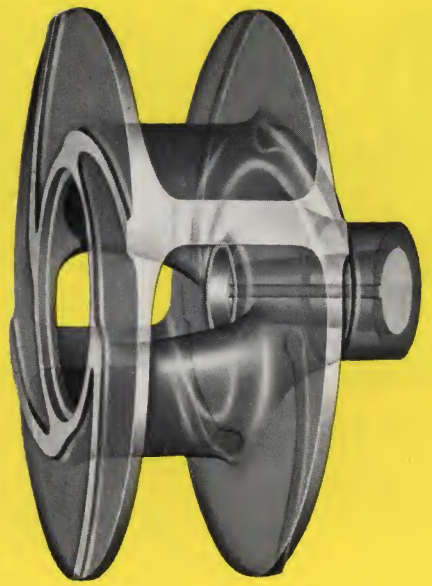
Type NCH Horizontal Waste Pump.

Non-clog in action as well as in name is the phrase used by engineers to describe the positive pumping action of these Peerless waste pumps.

Peerless' experience gained over a score of years in experimentation and refinement of sewage and waste disposal pumps is revealed in the important improvements in the Peerless non-clog design. All wearing rings, end plates, filler rings, etc., common to conventional pumps have been discarded in favor of an improved Peerless impeller with unique repelling vanes on both of its outer shrouds. These repelling vanes provide a pumping action similar to the working vanes between the shrouds, preventing an accumulation of solids in the space between the impeller and case side walls by agitating the solids into the center of the fluid stream. Peerless non-clog waste pumps, when properly selected for the disposal problem to be solved and when required to handle sizes of solids for which they are rated, will positively provide a long, trouble-free service life. Hundreds of installations of these pumps are operating in plants where solids in suspension in wastes have proved troublesome before the selection of Peerless Type NCV or Type NCH pumps. In addition to wide application in sewage disposal and lift stations, they provide superb performance in handling highway underpass storm water, paper mill waste, slaughterhouse refuse, cannery by-products and similar industrial and commercial wastes.



Two vertical close-coupled non-clog pumps installed in a sewage plant.



TWO-PORT IMPELLERS WITH UNIQUE REPELLING VANES ON OUTER SHROUDS AND SCIENTIFICALLY DESIGNED WORKING VANES OF UNIFORM THICKNESS DEVELOP POSITIVE NON-CLOGGING PUMPING ACTION

The design of the Peerless non-clog impeller is unique. The two working vanes are designed to give maximum efficiency when handling either relatively clear liquids or when solids are entrained. Except for the well rounded tips the working vanes are of uniform thickness. Rounded tips provide a smooth surface around which stringy or limp materials will readily flow. The uniform thickness of the Peerless impeller vanes also eliminates excessive and undesirable weight which would affect shaft and bearings and make for an unnecessarily cumbersome design. Repelling vanes serve to balance the hydraulic thrust and to place a lower pressure on the packing.

The repelling vanes cast on the outer shrouds of the impeller, clearly shown in the illustration at the left, are designed with a narrow face. In case some kinds of solids are forced between these vanes and the case, they are readily rolled out. Similar action with a wide vane would cause troublesome or even complete binding. Clogging at the suction opening into the impeller has been reduced to the minimum through providing the suction plate with a lip which extends slightly into the eye of the impeller, guiding the solids into position where they can be pumped. A handhole in the suction piece of the pump provides a convenient opening through which, if necessary, any clogging solids may be removed.

PEERLESS NON-CLOG WASTE PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-154.



THE MODERN DESIGN OF PEERLESS PROCESS PUMPS IS EXEMPLIFIED BY THESE REFINERY PROCESS PUMPS

PEERLESS PROCESS PUMPS



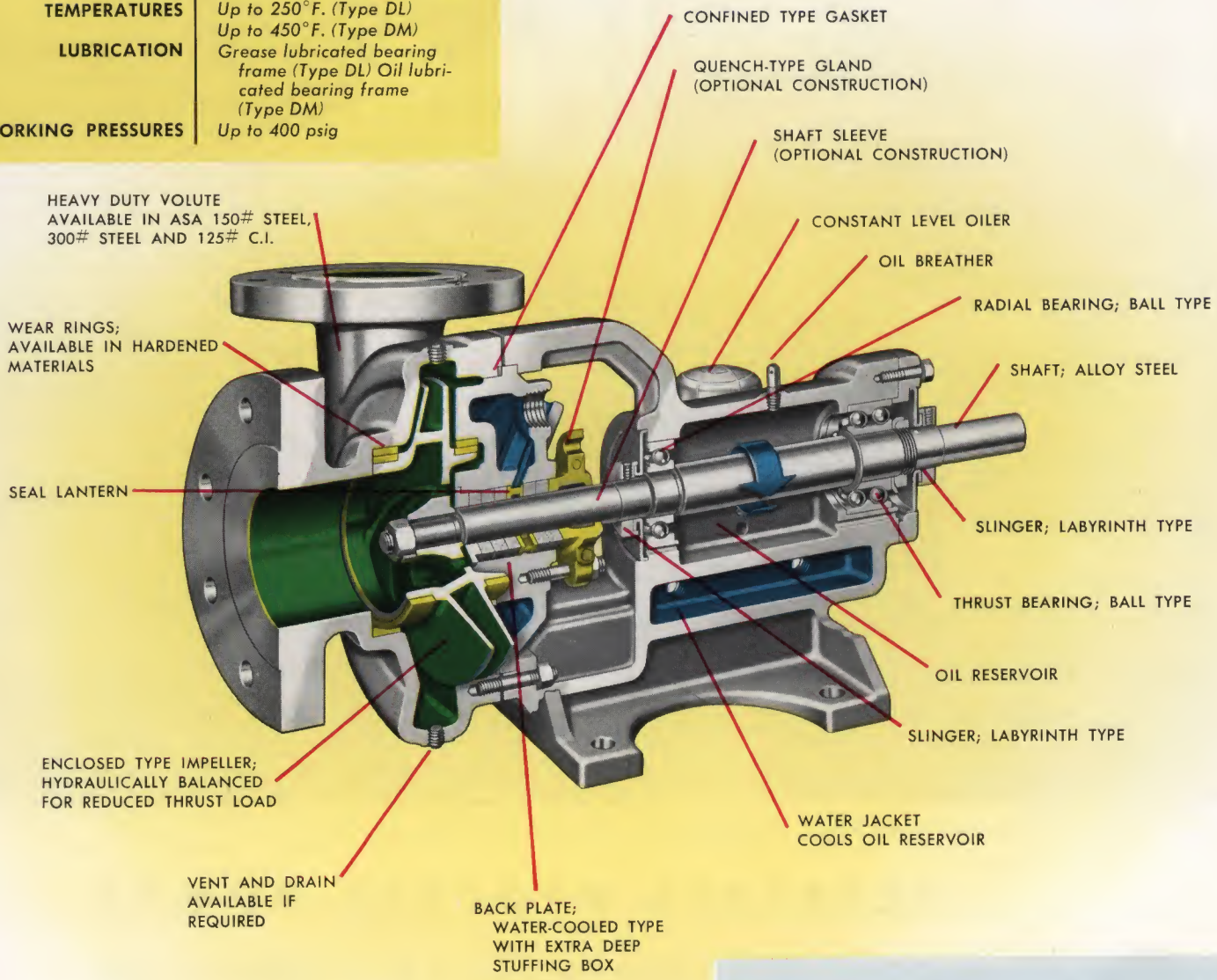
The design and construction of the horizontal and vertical pump types, which comprise the Peerless process pump line, are the results of a concerted effort by Peerless Pump Division to provide process pump users with quality pumps which combine both reasonable initial cost and long range low operational and maintenance costs.

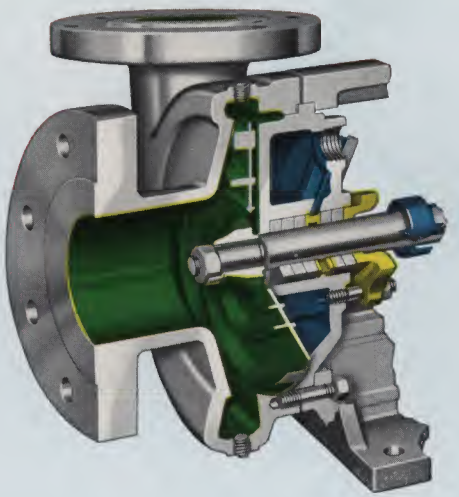
This goal of true process pump economy has been accomplished through a new concept of pump component interchangeability. Process pump application engineers will find that, within individual pump type groups, inventory and replacement pump parts can be measurably reduced and that initial capital investment in numbers of pump can be drastically cut. Yet, at the same time, even greater latitude in pump application is afforded, by consulting with Peerless for all your pumping requirements.

Comprehensive descriptions of Peerless process pump lines follow on succeeding pages. Horizontal pump types include: chemical process pumps Types DL and DM; chemical transfer pumps Type CTB; refinery process pumps Types PR and PRS. Vertical types include: the Peerless Hydro-Line can type pump and heavy duty process type of close-coupled industrial service pump. This section also includes a brief description of Peerless' research and development activities in the field of specialty process pumps. Pump developments resulting from this area of specialization are being applied to nuclear-powered submarine service and to nuclear power steam generating stations, research reactors and similar governmental and private industry power developments.

PEERLESS TYPE DL-DM

CAPACITIES	*Up to 800 gpm*
HEADS	*Up to 430 feet*
DRIVES	*Electric motor or steam turbine*
TEMPERATURES	*Up to 250°F. (Type DL)*
	Up to 450°F. (Type DM)
LUBRICATION	*Grease lubricated bearing frame (Type DL) Oil lubricated bearing frame (Type DM)*
WORKING PRESSURES	*Up to 400 psig*





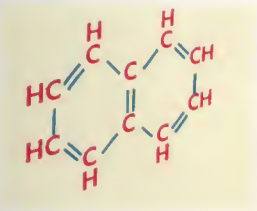
OPEN TYPE IMPELLER

View above shows the Type DM with enclosed impeller cutaway to illustrate construction details.

View of the Type DLO pump (O designates open impeller), at the right shows the difference in construction details in the liquid end when open type construction is used. View shows standard construction, without quench type gland or shaft sleeve. For specific recommendations on the application of open or enclosed type impellers, the Peerless engineering department offers a consulting service.

PROCESS PUMPS

CENTRIFUGAL END SUCTION DESIGNS WITH OPEN OR ENCLOSED IMPELLERS

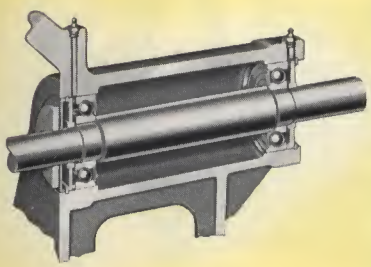


Peerless Type DL and Type DM pumps are probably as close an approach to truly all purpose chemical pumps as are available to industry. Remembering that "quality first and cost second" are the key demands of process pump application engineers, Peerless offers this line of process pumps to completely fulfill these requirements. No compromise with quality is made in the Type DL-DM manufacture. Every exacting standard of the process industry has been met. A new concept of component interchangeability combined with initial low cost provides pump users with a completely practical approach to economy with quality in process pump installation, operation and maintenance. Users of large numbers of process pumps can cut inventory of replacement parts as much as 85%. Besides reduced capital investment, greater versatility in application and the opportunity to always have the most efficient pump for every liquid condition are most important benefits resulting from this new concept.

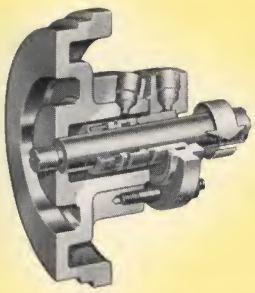
In general, Peerless Type DL and Type DM pumps are single stage, horizontal centrifugal pumps with a vertically split liquid end. Two different frames are available, one an oil lubricated bearing housing, designated as Type DM, and the other a grease lubricated bearing housing, designated as the Type DL.

The availability of these two different pump frames to which the desired type of back plate, impeller and pump volute, may be added to obtain the pump to fit your requirements, is the basis for the Peerless idea of pump component interchangeability mentioned above.

Each pump frame accommodates any combination of pump liquid end components in 4 sizes on an 8½" frame and in 5 sizes on a 10½" frame. Liquid ends for each pump frame can be furnished with an open type impeller with repelling vanes or an enclosed type impeller with balance chamber. A water cooled or non-water cooled back plate is available with this assembly. Visualize the economies of having all pump components fit both types of bearing housings. If it becomes necessary to change components because of a change in pumping conditions just apply the new size components to either bearing frame. A schematic diagram showing how you can order or assemble the pump with the construction features you want is sketched on the following pages.



BEARING HOUSING This cutaway view of the Type DL (grease lubricated) bearing housing is provided for comparison with the cutaway view of oil lubricated bearing housing of the type DM, above left.



MECHANICAL SHAFT SEAL The cutaway view above shows pump construction with a shaft seal. Both Type DM and Type DL pumps may be so equipped. Pumps are designed to accommodate seals of several nationally known makes.



Type DM chemical process pump, exterior view. This is the oil lubricated bearing housing, with provision for water cooling of housing; back plate is water cooled.



Type DL chemical process pump, exterior view. This is the grease lubricated bearing housing. Back plate has provision for water cooling.

DESIGN AND CONSTRUCTION FEATURES:

TYPE PUMP: Both Types DL and DM pumps are horizontal, foot mounted, vertically split case pumps, with end suction and top discharge. The following combinations of components are available.

TYPE DL PUMP: Grease lubricated bearings, air-cooled, enclosed impeller.

TYPE DM PUMP: Oil lubricated bearings, water-cooled, enclosed impeller.

TYPE DLO PUMP: Grease lubricated bearings, air-cooled, open impeller.

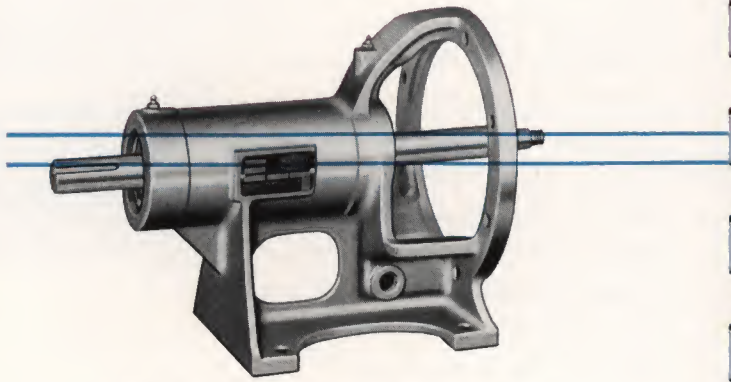
TYPE DMO PUMP: Oil lubricated bearings, water-cooled, open impeller.

TEMPERATURE RANGE: With steel construction Type DM and Type DMO (open impeller) these pumps can be used to a maximum temperature of 450°F. The Type DL and Type DLO (open impeller) can be used to a maximum temperature of 250°F.

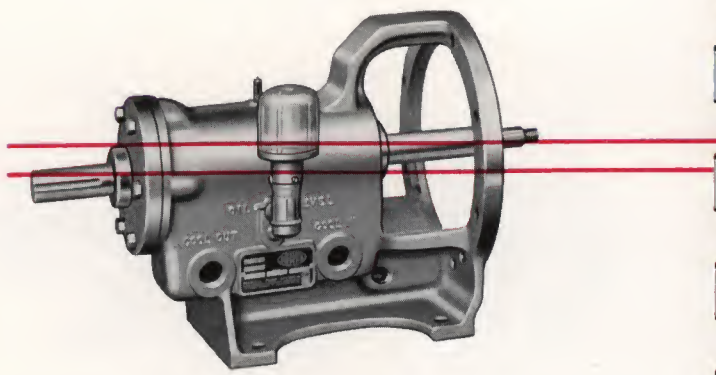
SIZES AND PERFORMANCE: Both pump Types DL and DM can be furnished in either 8½" or 10½" frame size. The 8½" frame size will accommodate 4 sizes of liquid ends, 1" through 3" discharge. The 10½" frame size will accommodate 5 sizes of liquid ends, 1" through 4" discharge. Capacities up to 800 gpm and heads to 430 feet can be handled by these types.

BACK PLATE: Air-cooled or water jacketed back plate can be furnished on all types to meet pumping requirements.

IMPELLERS: Both enclosed type impellers with balance chamber or open type impellers with repelling vanes, are available. Impellers are dynamically balanced for operation at 3600 rpm, unless otherwise specified.



GREASE LUBRICATED BEARING HOUSING



OIL LUBRICATED BEARING HOUSING

To either the **DL** *or* **DM** *frame add the desired*

VOLUTE: Cast iron construction, with 125 lb. flat face ASA suction and discharge flanges. Steel construction provides 150 lb. raised face ASA flanges and 300 lb. raised face ASA flanges.

VOLUTE GASKET: Volute gasket is of the confined type in accordance with refinery standards.

WEAR RINGS: Wear rings are spot electric welded (or brazed) after being pressed into position. Volute rings are standard for Types DL and DM. Impeller rings are furnished on request on Types DL and DM; none are required on Types DLO and DMO.

PACKING: Each pump is provided with 5 rings of asbestos packing—3 rings under and 2 rings above lantern ring.

PACKING GLAND: Packing gland is available in either non-quench, split type or quenched split type.

MECHANICAL SEALS: Furnished in place of packing, when specified.

PUMP SHAFT: Pump shafts are solid, without sleeve as standard. Shaft sleeves will be furnished when specified.

BEARINGS: Types DL and DLO are single shield, grease lubricated. Types DM and DMO are single shield, oil lubricated. On 10½" pump, double row thrust bearings are standard.

LANTERN RINGS: Precision cast lantern rings are standard.

OIL ENCLOSURE: On the Type DM pump, a labyrinth type steel oil enclosure eliminates leakage of oil from the pump frame.

BASE PLATES: Either a standard steel channel base or a fabricated drip-rim base is available. Cast iron bases are also available.

COUPLING: Standard coupling is flexible, semi-steel. Gear or spacer type couplings furnished when specified.

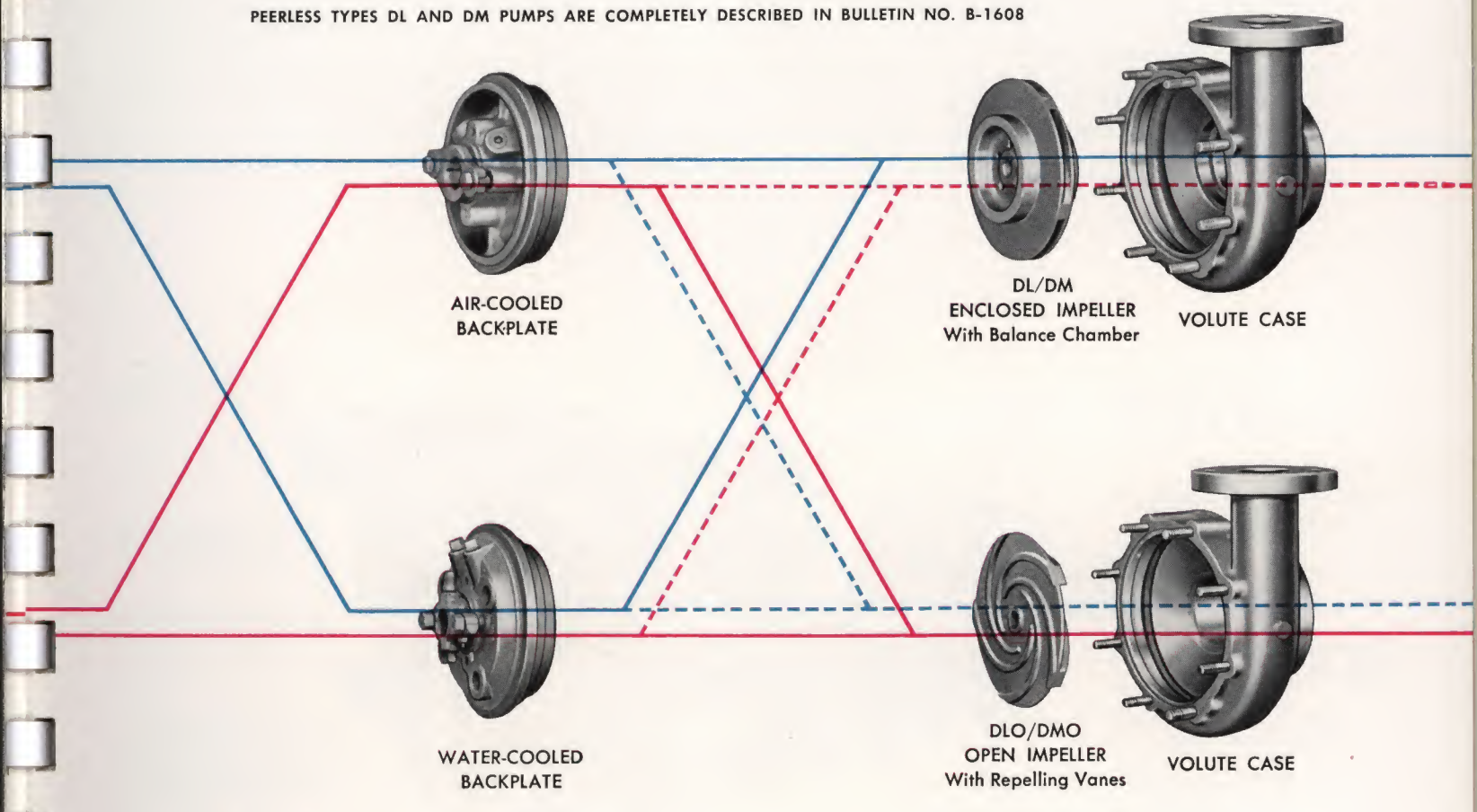
SPEEDS: For Types DM, DMO and DL 3600 rpm is maximum. For Type DLO 1800 rpm is maximum.

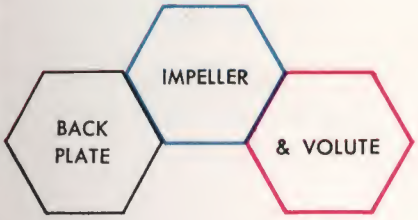
ROTATION: Pump rotation is counter clockwise (left hand) when viewed from the driver end.

CASTINGS: Two sets of pattern equipment are maintained to insure maximum casting quality and service. One set is for cast iron and bronze and one set is for steel.

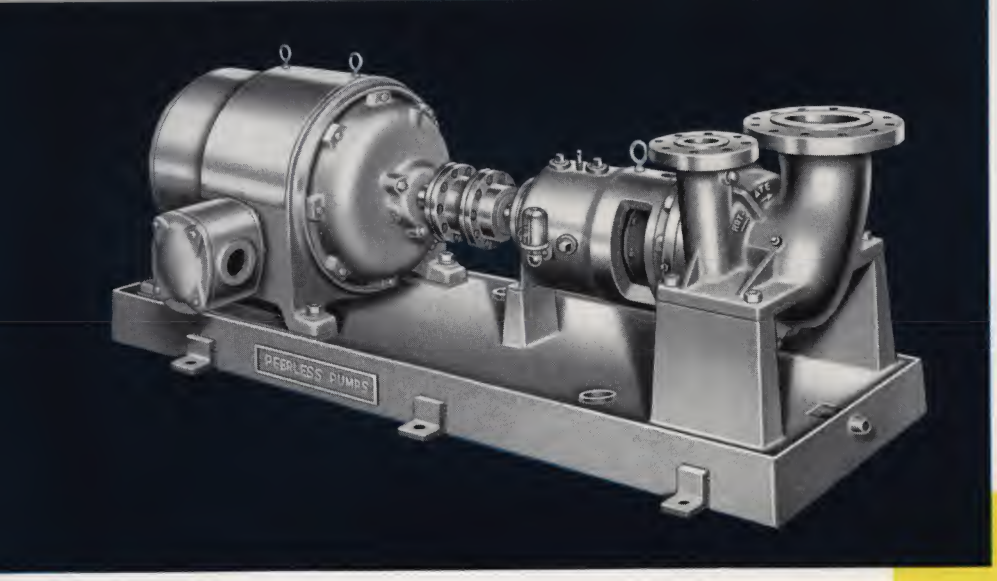
MATERIALS OF CONSTRUCTION: Materials for Type DL and Type DM pumps can be any machinable metal. A large stock of component parts in the most commonly used materials is maintained for prompt service in shipping both complete pumps and replacement parts.

PEERLESS TYPES DL AND DM PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1608





to obtain the pump to fit your requirements.



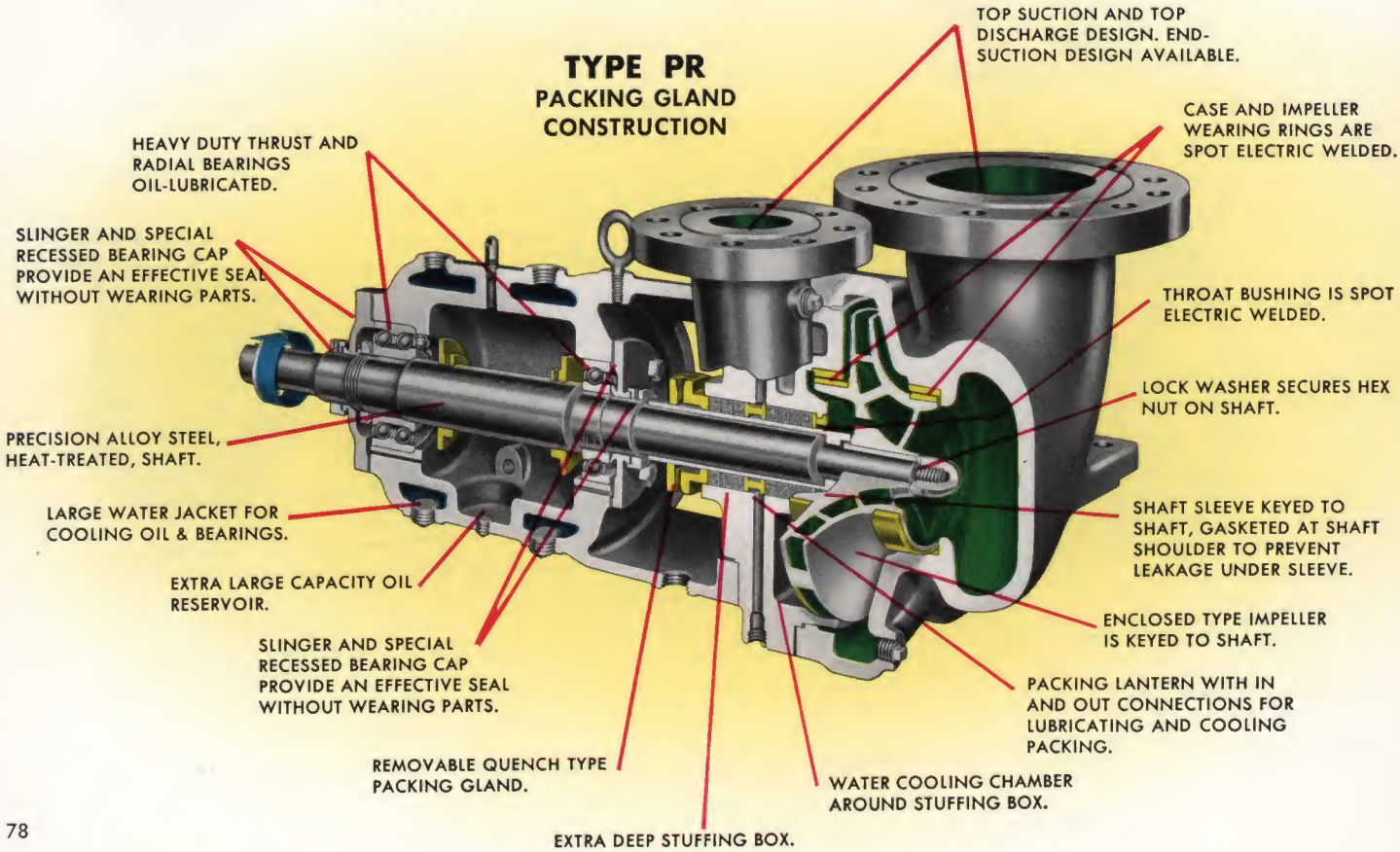
PEERLESS TYPE PR

Type PR model, shown with driver, is a top suction, top discharge design, with packing gland construction. End suction, top discharge designs are also available for both packing gland and mechanical shaft seal construction.

CAPACITIES	*up to 1200 gpm*
HEADS	*up to 900 feet*
TEMPERATURES	*up to 850°F (Type PR)* *up to 250°F (Type PRS)*
CASE PRESSURES	*up to 900 psi, cold (Types PR and PRS)* *up to 600 psi, hot (Type PR)* *up to 300 psi, hot (Type PRS)*
DRIVES	*electric motor; steam turbine; as required.*
LIQUIDS HANDLED	*hydrocarbons, hot water.*
SIZES	*1" to 4" inclusive*

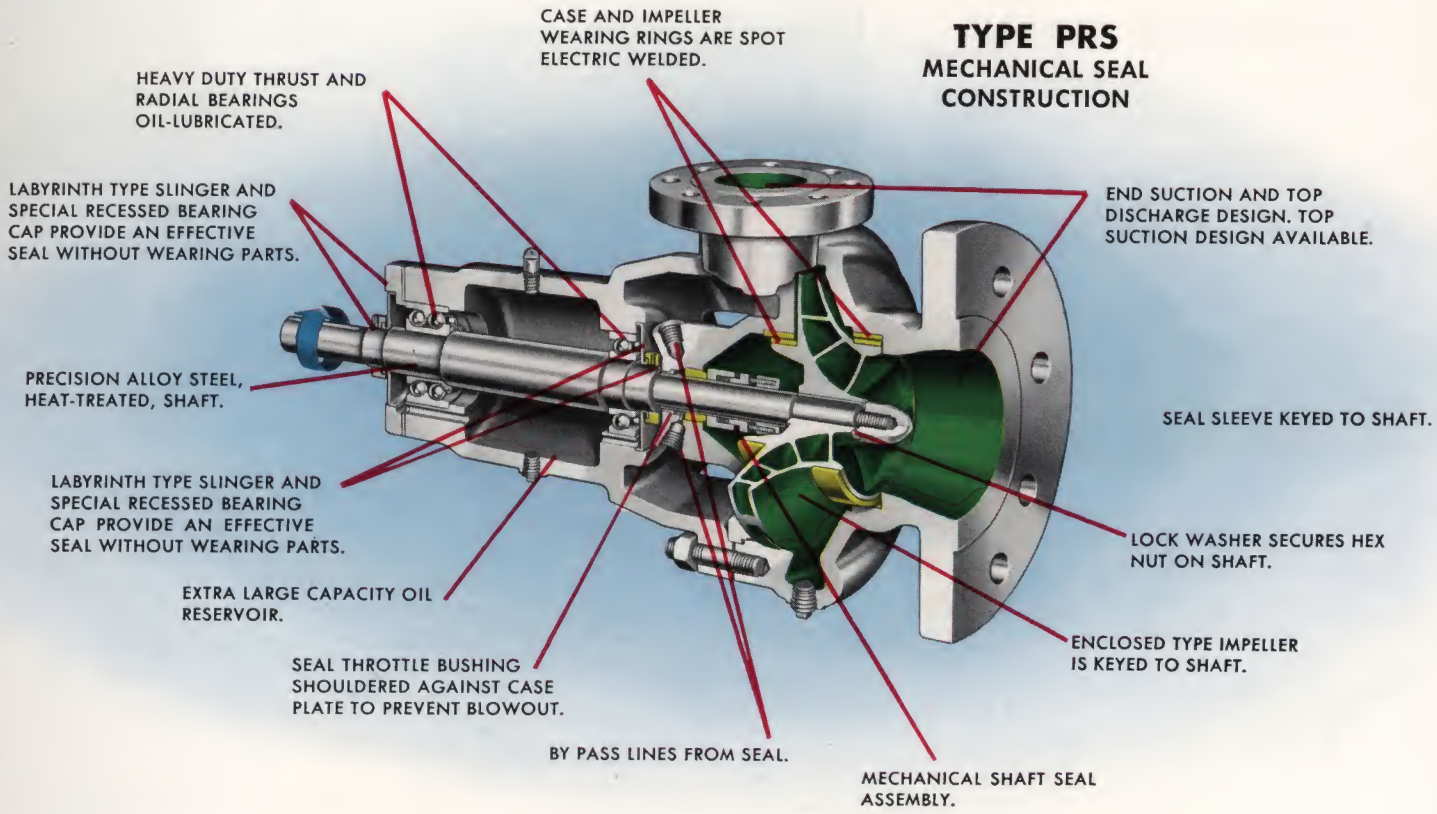
Peerless has designed this line of heavy-duty, center line, pedestal mounted pumps especially for the high temperature, high pressure duty of refinery process pumping. Two models are available. One, Type PR, of packing gland construction, is designed for temperatures up to 850°F.; the other, Type PRS, designed around and for a mechanical shaft seal, is for temperatures up to 250°F. Both top suction, top discharge and end suction, top discharge models are available in each type.

From the head-capacity characteristics of the Type PR and PRS, it will be seen that nearly all the conditions of modern refinery process liquid transfer can be met. Hot oil, hot water, petroleum hydrocarbons and many chemicals can be handled. Both pump types have a head range of up to 900 feet and a capacity range of up to 1200 gpm. Case pressures are designed for 900 psi, handling cold liquids and up to 600 psi, handling hot liquids. Pump liquid ends can be furnished in any machinable alloy. Iron, carbon steel, and stainless steel are available from stock.



AND PRS PROCESS PUMPS

A heavy duty pump for refinery process applications . . .



Both Type PR and Type PRS pumps can be furnished in 8½", 10½" and 13" frame sizes. The 8½" frame size will accommodate 4 sizes of liquid ends, 1" through 3" discharge. The 10½" frame will accommodate 5 sizes of liquid ends, 1" through 4" discharge. The 3" frame size will accommodate 3 sizes of liquid ends, 2" through 4" discharge.

Inspection of the cutaway views of each of the two pump types will show the many quality construction details incorporated by Peerless to insure continuous duty in refinery service. From the outboard dual thrust bearing all along the shaft and case to the steel flanges (ASA 300# or ASA 600#) raised faced flanges are standard. Paramount consideration is given to operating and safety features that are to be found only in quality pump construction. Here are a few:

Volutes and impellers are completely interchangeable between the two pump types. Balance ring impeller construction is standard; repelling vanes on impellers are an optional feature. Both case and impeller rings are spot electrical welded or brazed. Heavy duty thrust and radial bearings are oil lubricated. An extra large oil reservoir is provided. Labyrinth slingers and bearing outside both ends of the bearing housing keep oil from leaking out or dirt from entering housing. An extra deep water jacketed stuffing box is provided on the Type PR pump. Packing lantern has "in" and "out" taps for lubricating and cooling the packing. The Type PRS has bypass lines for cooling the shaft seal. Pump shafts are solid, made of precision heat treated alloy steel. The pedestal support beneath the pump case prevents pipe strain being imposed on rotating parts. Water cooling for the pedestal is available. Cantilever type bearing housing, used in conjunction with a spacer type coupling permits removal of rotating parts or pump for inspection or maintenance without disturbing piping or driver. And, a large stock of commonly used parts is maintained for prompt service in shipping both complete pumps and replacement parts.

PEERLESS TYPE PR AND TYPE PRS PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1605

PEERLESS
CTB
CHEMICAL TRANSFER PUMP



CAPACITY	*10 to 200 GPM*
HEAD	*10 to 140 feet*
HP RANGE	*¼ to 10 hp*
CASE PRESSURE	*100 lbs*
LIQUID TEMPERATURE	*up to 250° F. Liquid end constructed of Type No. 20 stainless steel alloy*

A mechanically shaft sealed pump for continuous or intermittent light duty in transferring corrosive chemical solutions. Wetted end constructed of type No. 20 stainless steel alloy makes it suitable for pumping corrosive liquids at moderate temperatures and pressures. Acids, bases, salts, organic and inorganic solutions of nearly all types are within the capabilities of the Type CTB pump.

The Peerless Type CTB chemical transfer pump is one of a number of new and modern Peerless process service pumps for which Peerless has gained an enviable reputation throughout the process industries.

Practically all the requirements of low temperature and low pressure chemical transfer service can be successfully met with the Peerless Type CTB pump. This simply designed, ruggedly constructed pumping unit is built to assure the long in service continuity that chemical plant engineers and operators demand. The low operational and maintenance costs of the Type CTB meet every requirement for economy over an extended service life.

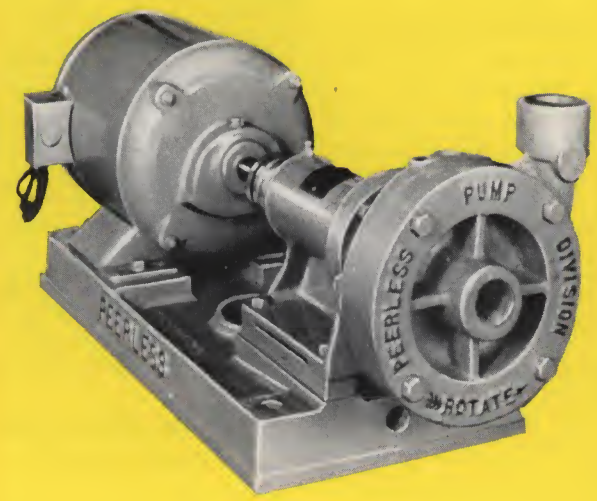
The Type CTB is furnished with wetted end made of type No. 20 stainless steel alloy from factory stocks. The steel alloy castings for the Type CTB pump are made in a foundry whose entire output is exclusively directed to this type of specialized quality work. Constant control of uniformity in workmanship and casting quality is rigidly exercised. Castings are machined in Peerless' Indianapolis factory where new and modern precision machine tools are available for precise finishing.

Peerless Type CTB pumps utilize semi-open impellers to assure efficient and effective transfer of solutions with minimum clogging within the pump.

The mechanical shaft seal, as utilized in the Peerless Type CTB pump, is a positive sealing device especially designed for the corrosive liquid condition encountered in chemical transfer service. Each seal is an integral, self-contained unit, assembled and tested in the Peerless factory. The use of mechanical shaft seal as an integral part of the pump has these major advantages: reduces shaft overhang, reduces bearing loads and reduces shaft run-out at the seal; further, it accomplishes a sizable reduction in pump and seal costs.

The long life, dependability, excellent performance characteristics and low initial cost of the Type CTB are features which commend its application when plans call for a quality chemical transfer pump capable of handling corrosive liquids in the temperature, pressure and capacity range indicated.

PEERLESS TYPE CTB PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1606



View from pump end of Type CTB unit. Rotation is clock-wise and viewed from motor end. Screwed connections are standard on ¾" discharge sizes.

PEERLESS PROCESS TYPE HYDRO-LINE® PUMP

CAPACITIES	*Up to 3000 gpm*
HEADS	*Up to 1000 feet*
DRIVES	*As required; standard vertical solid shaft or explosion proof motors, steam turbine drive*
TEMPERATURES	*Up to 400°F*

IN RECENT YEARS there has been an increasing tendency on the part of engineers to specify pumps of the vertical type for the transfer of process liquids and water. Three most important considerations commending this type of pump for installation are:

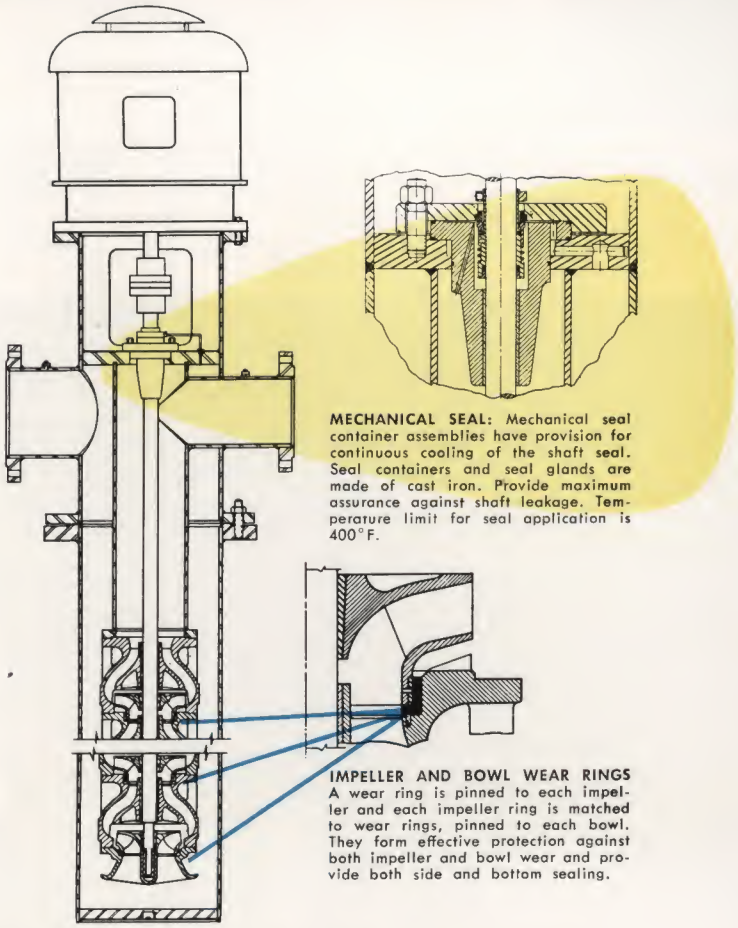
1. The flexibility of this vertical type construction to meet present as well as future plant requirements.
2. The excellent adaptability of this type of pump to the pumping system's present available NPSH (net positive suction head).
3. The space saving, hence cost saving design of the vertical rotative shaft type pump.

Now to these important reasons for Hydro-Line selection Peerless engineers have added a fourth:

4. The availability of the Hydro-Line pump in process-type construction.

The process type Hydro-Line, an encased can type, close-coupled, vertical pump, is especially engineered to meet the rigid requirements of process and refinery service and high temperature power plant service.

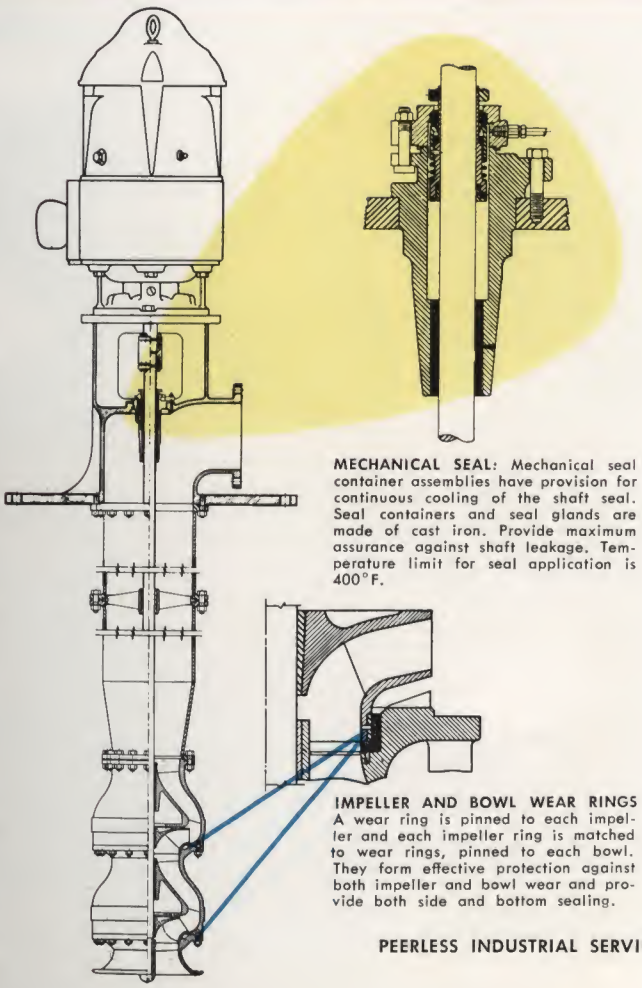
The design and construction features of the Hydro-Line process type pump with the optional construction of flanged type or spacer type couplings for stuffing box or mechanical shaft seal construction and the use of impeller and bowl wear rings commends it to many process pump applications.



MECHANICAL SEAL: Mechanical seal container assemblies have provision for continuous cooling of the shaft seal. Seal containers and seal glands are made of cast iron. Provide maximum assurance against shaft leakage. Temperature limit for seal application is 400°F.

IMPELLER AND BOWL WEAR RINGS A wear ring is pinned to each impeller and each impeller ring is matched to wear rings, pinned to each bowl. They form effective protection against both impeller and bowl wear and provide both side and bottom sealing.

PEERLESS HYDRO-LINE PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-1700



MECHANICAL SEAL: Mechanical seal container assemblies have provision for continuous cooling of the shaft seal. Seal containers and seal glands are made of cast iron. Provide maximum assurance against shaft leakage. Temperature limit for seal application is 400°F.

IMPELLER AND BOWL WEAR RINGS A wear ring is pinned to each impeller and each impeller ring is matched to wear rings, pinned to each bowl. They form effective protection against both impeller and bowl wear and provide both side and bottom sealing.

PEERLESS SPECIAL SERVICE INDUSTRIAL SERVICE PUMP

CAPACITIES	*Up to 1400 gpm*
HEADS	*Up to 300 psi*
DRIVES	*As required; standard vertical solid shaft or explosion proof motors; steam turbine*
TEMPERATURES	*Up to 400°F*

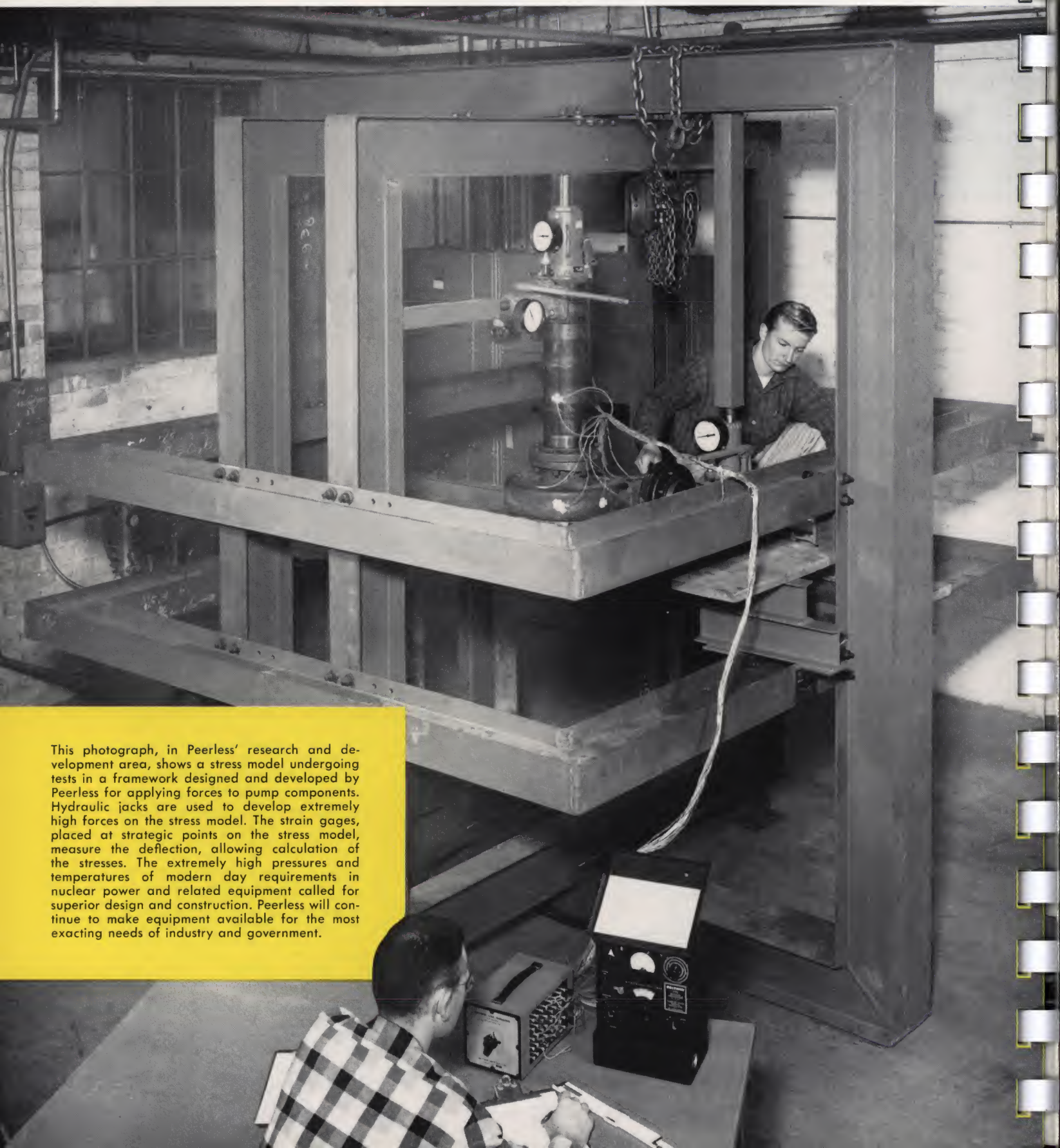
The Peerless close-coupled, vertical, process industrial service, turbine type pump has always been ideal for liquid transfer when short settings are involved. One of the outstanding reasons for its complete acceptance has been that the use of a vertical type pump eliminates the necessity of either all or a greater proportion of system suction piping.

Furthermore, the vertical type design, once primed, eliminates the necessity of further pump priming and permits installation in a restricted space. In addition Peerless' vertical design permits utmost flexibility in adapting the pump to future system needs simply by adding to or subtracting from the number of bowl units (or stages) required by the system's conditions.

Of paramount importance to process pump buyers are these features of the Peerless vertical pump: the use of economical solid shaft motors, with the availability of hollow shaft electric motors if desired; the use of flanged type couplings on the pump column (with the availability of screwed column if desired); open line shaft construction (with availability of enclosed line shaft construction or oil lubrication, if required); bronze, neoprene or other synthetic type composition bushings; L type wear rings and lateral seal rings on pump bowls; and the utilization of bell mouth suction manifold in conjunction with improved impeller design—the latter feature making possible installation with the minimum of submergence and the virtual elimination of vortexes at the pump suction.

PEERLESS INDUSTRIAL SERVICE PUMPS ARE COMPLETELY DESCRIBED IN BULLETIN NO. B-505

PEERLESS SPECIALTY



This photograph, in Peerless' research and development area, shows a stress model undergoing tests in a framework designed and developed by Peerless for applying forces to pump components. Hydraulic jacks are used to develop extremely high forces on the stress model. The strain gages, placed at strategic points on the stress model, measure the deflection, allowing calculation of the stresses. The extremely high pressures and temperatures of modern day requirements in nuclear power and related equipment called for superior design and construction. Peerless will continue to make equipment available for the most exacting needs of industry and government.

PROCESS PUMPS

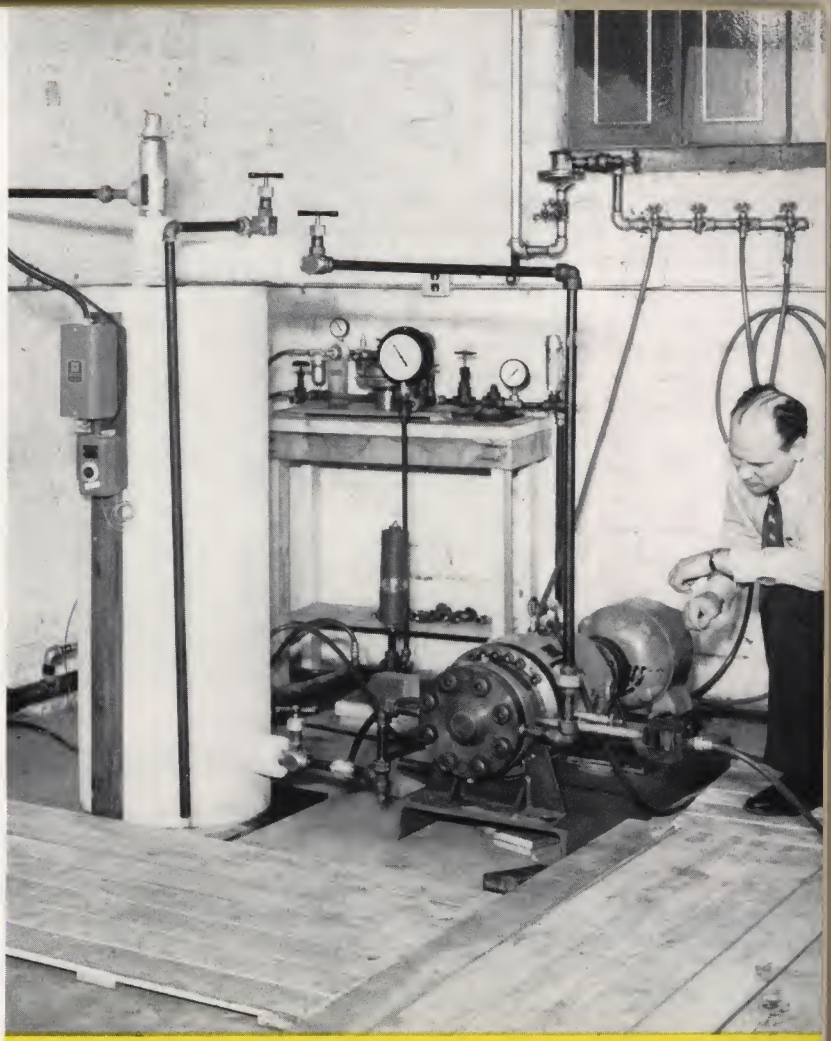
Today's requirements for moving fluids for industry and for many government projects present a great challenge. To provide for the highest quality pumping equipment for all applications, Peerless Pump Division is continually expanding its facilities for research, design and development.

Peerless process pumps for difficult chemical solutions are being manufactured commercially. These include vertical and horizontal process pumps for the most corrosive and novel solutions. For example, pumps have been designed and developed to handle hydrogen peroxide, hot, radioactive nuclear liquids and reactor circulating solutions.

Peerless is able to solve many of today's modern difficult pumping problems, and by collaboration with leading universities and institutions, we have the benefit of the most modern scientific thinking applied to your problems. Coupled with our 35 years of experience, you are assured of quality, service and satisfaction. Modern foundry techniques, metallurgical developments and the most modern kinds of testing equipment in the United States give important advantages in building Peerless pumps for all your needs.

We welcome your inquiries for all types of centrifugal pumps which are not now included in any manufacturer's standard line. These pumps generally would be highly specialized in nature, and we will be glad to give consideration to designing and building all types of pumping equipment—whether horizontal or vertical—whatever your needs may be.

Address your inquiries to our Los Angeles Works.



Illustrated above is a test loop designed and developed by Peerless engineers to test leakage limiting devices. Temperatures up to 600° F and pressures to 2,500 psi. can be applied to shaft seals or other leakage limiting devices, while continuously operating under field conditions. This kind of research and development is a part of Peerless' advancing program to keep step with the new technology and application requirements in industrial and governmental pump requirements.



In 1950, Peerless set up a research and development group in its engineering department to study problems propounded by industry and government for pumping high pressure and high temperature liquids. Out of these group efforts have come several successful developments. For example, Peerless has furnished pumping elements for atomic powered submarine service and limited leakage pumps for atomic powered steam generating stations, research reactors, as well as other uses. Peerless continues its leadership in the pumping field by such advanced and forward looking moves as this.



AIR VIEW OF THE LOS ANGELES WORKS OF THE PEERLESS PUMP DIVISION, FOOD MACHINERY AND CHEMICAL CORPORATION

CONCERNING PEERLESS

AIR VIEW OF THE INDIANAPOLIS WORKS OF THE PEERLESS PUMP DIVISION, FOOD MACHINERY AND CHEMICAL CORPORATION



The Peerless Pump Division of the Food Machinery and Chemical Corporation has reached an importance, in modern life and industry, comparable to that of the pump itself.

The pump – indispensable adjunct of industry. The pump – that is the pulsing heart in the production of food, in the garden, the grove, the farm, or the range.

The pump delivers water, to the surface, from its prison below ground. On the surface it raises water from level to level, serving a thousand uses in industry and agriculture. It redistributes the water from nature's vast resources, which is converted to steam for electrical power for petroleum refineries, chemical process industries, municipalities, and thousands of industrial uses.

It was the sound made by the crude plunger in original devices that, in the sixteenth century, developed the echoic word "pump." Man's ingenuity, down through the centuries, has developed more and more efficient pumps. Today, thousands of Peerless Pumps deliver water "from a tapful to a torrent" and pumping efficiency has risen to new heights.



One of the Major Divisions of the Food Machinery and Chemical Corporation

In the hands of Peerless engineers, pumps have been developed to meet vital hydraulic requirements of all industry, agriculture and domestic dwellings. Every Peerless pump, whether it delivers a tapful or a torrent; for mammoth industrial or municipal installations, or whatever its use, is engineered and built to most exacting standards of performance and endurance.

So, early in the years in which the Peerless pump tradition was in the making, Management insured its Customers against all but the shortest possible interruption in service, due to unavoidable causes. It did this by pacing distribution with a nationwide network of field service facilities. Thus the buyer has come to know that the old legal maxim of **caveat emptor,** or "let the buyer beware," does not apply in the case of Peerless pumps. Once sold, the pump customer acquires, in addition to the fashioned metals with their known performance, an assurance that Peerless stands solidly behind the product. He knows that, somewhere close at hand, a Peerless service man, strong in the faith of enthusiasm and loyalty to the product, will maintain the standard of performance that is Peerless.

. . . That is the Peerless tradition – to sell good pumps and to keep them pumping, until, at long last they have performed to the full the function for which they originally were designed and produced, well deserved of the admiration of both the Manufacturer of and the Customer of Peerless pumps.

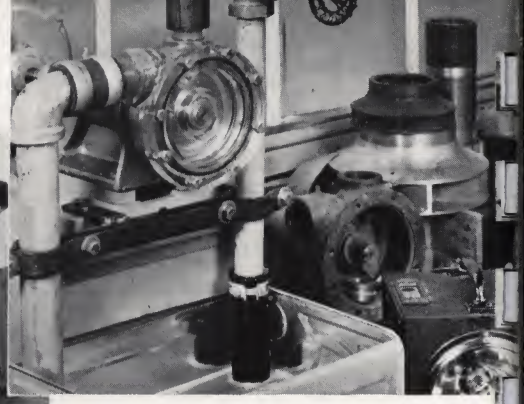
Users of Peerless pumps include the petro-chemical industry, railroads, sugar mills, municipal water works, flood and storm control districts, chemical and other processing plants, packing houses and canneries, farms, mines and countless other industries. In fact, most everywhere liquids are moved, Peerless pumps have been and can be successfully applied.

To keep ever abreast of the responsibility for supply, which the reputation of Peerless Pumps has developed, the Peerless Pump Division of Food Machinery and Chemical Corporation operates two major manufacturing plants—one at Los Angeles, California, the other at Indianapolis, Indiana. These plants have a combined floor space of over 350,000 square feet. Extensive service centers are located at Fresno, California; Phoenix, Arizona, and at Plainview and Lubbock, Texas. Division operated sales offices, staffed with field sales-engineering experts, are located in New York, Atlanta, Indianapolis, Chicago, San Francisco, St. Louis, Lubbock, Albuquerque and Los Angeles. These offices also form the nucleus for a world-wide network of independent Peerless distributor and dealer sales-engineering and service organizations. The great resources of the manufacturing and dealer organizations in the Peerless Pump Division, provide the utmost assurance to customers that their pump has the backing of a major organization, which stands solidly behind its products.

Lying beyond the vista of all that goes into a Peerless pump; beyond the metallurgy, engineering, and hydraulics; beyond the superb craftsmanship and quality, there appears the assurance of unfailing maintenance service. Years of quality-plus manufacturing have produced a pump that is, as the name implies—**peerless.**

DESIGN





Product design and development is a continuing Peerless study. View at left shows a portion of the Los Angeles engineering department. The plastic volute pump above, in conjunction with a stroboscope, permits photography and analysis of pumps while in operation.

FOUNDRY

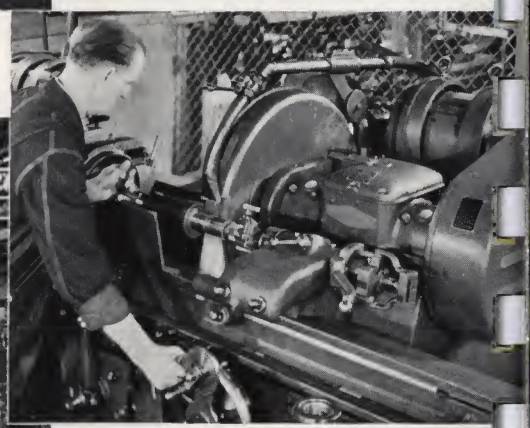




Metallurgical and quality control of Peerless castings is exacting. Views at the left and above are in the FMC's Mechanical Foundries Division, which provides Peerless with castings for both its Los Angeles and Indianapolis works.

MACHINERY

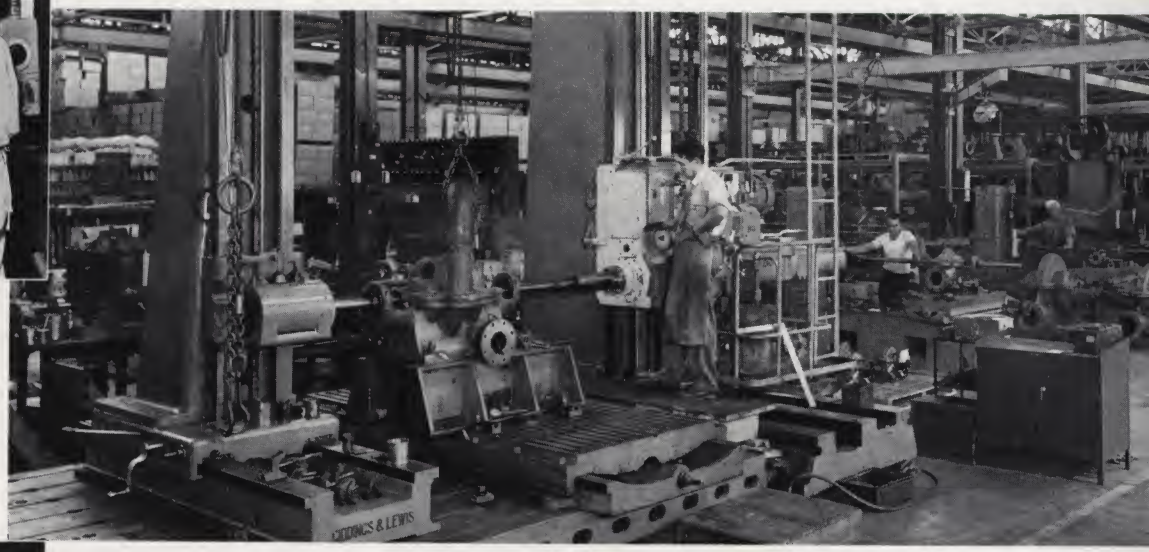




Modern automatic machinery helps assure lowest product costs. At the left is one of the modern manufacturing bays at Peerless' Indianapolis works. In the picture above, the operator is machining a precision pump part.



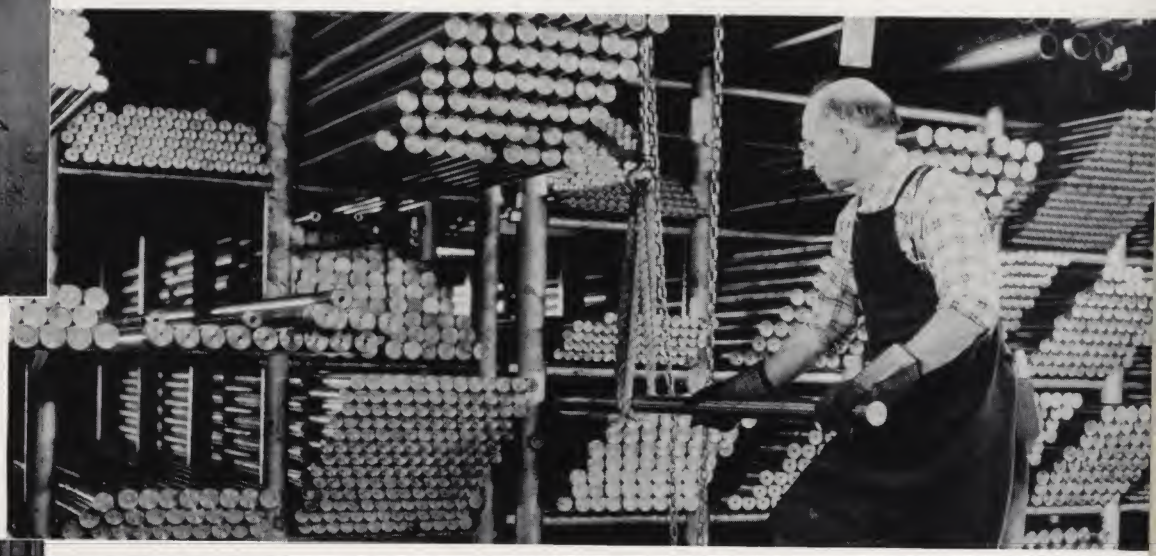
MACHINING



Precision methods contribute to superior Peerless pump performance. The large horizontal boring mill, right, and the vertical boring mill, above, are typical of Peerless' utilization of the modern machining techniques.



SHAFTING



The stocking of shafting of proper sizes and analyses is an essential requirement at Peerless. View at the right shows a portion of this stock. The operator in the view above is swaging a Monel sleeve onto a length of shafting.



ASSEMBLY

In the view at the left two operators carefully assemble a 30″ vertical multi-stage turbine pump. Below are shown a number of types of Peerless horizontal centrifugal pumps being made ready for inspection and test.

SHIPPING

Carefully and strongly crated to insure safety in transit, Peerless pumps are shipped via rail, ship, truck and even by air. The view below shows a truck shipment being made from the Peerless Los Angeles works.







Above: Testing a Type A general purpose horizontal centrifugal pump, to establish pump performance characteristics of head, capacity, horsepower and efficiency. The test station equipment shown includes electric dynamometer with control desk, mercury suction gages and discharge pressure gages. The calibrated scales shown measure the brake horsepower requirements of a pump by accurately measuring the torque. This is one of the eight test stations in this laboratory.

At left: The test panel records motor rpm electrically as well as providing for gaging head pressures.

At right: General view showing eight test stations in the new quarter million dollar pump testing laboratory at the Indianapolis Works of the Peerless Pump Division. Pumps of all sizes and capacities from 5 to 86,000 gallons a minute and from 1 to 1000 hp can be accurately tested in this laboratory, which is believed to be the biggest of its kind in the United States.

In addition to the testing of Peerless pumps during manufacture, this extremely modern equipment provides excellent facilities for tests on new pump designs for pumps in the formulative stage. Peerless proves and improves its products to produce superior pumping equipment for its growing world-wide market.

PROVING AND IMPROVING THROUGH PUMP TESTING

An investment, by Peerless, of over a quarter of a million dollars for construction of what is believed to be the largest pump testing laboratory in the United States, offers powerful new evidence of insured "in use" perfection for Peerless pumps.

The new test laboratory was completed in 1950, at Peerless' Indianapolis works. The extent to which the pump engineers carried their quest for meticulous testing aroused instant interest and favorable approval in the country's industrial press.

Such a painstaking extension of pump manufacturing insures the ultimate in product quality for Peerless pump users. It further guarantees performance by simulating almost every type of field condition, assuring the customer pump performance far in excess of his indicated requirements.

The Peerless Indianapolis testing laboratory occupies over 7,000 feet of floor space. The main "lab" contains 8 pump stations with provision for an additional 4 stations. Greatest precautions are taken to rule out any variation in the power which actuates the pumps. Both high and low voltage equipment is available, making possible the use of motors up to 1000 hp in size.

Peerless pumps are tested to register their complete performance characteristics, to observe their operation, and to compare results in the laboratory with calculated design performance data. This requires exact measurement of the amount of water, or capacity, handled by the pump; the head against which it is operating; the power input to the pump, and the exact speed of operation during the measurement of input and output factors.

Insuring the requirement of the pump testing laboratory's large supply of water is a test pit 30 feet wide, 192 feet long, and 12 feet deep. At one end a circulating pit sinks 40 feet to provide for the testing of vertical pumps. A dividing wall in the rectangular pit permits drainage of one half, while tests are being carried on in the other half. This arrangement also permits calibration of large meters, by displacement method.

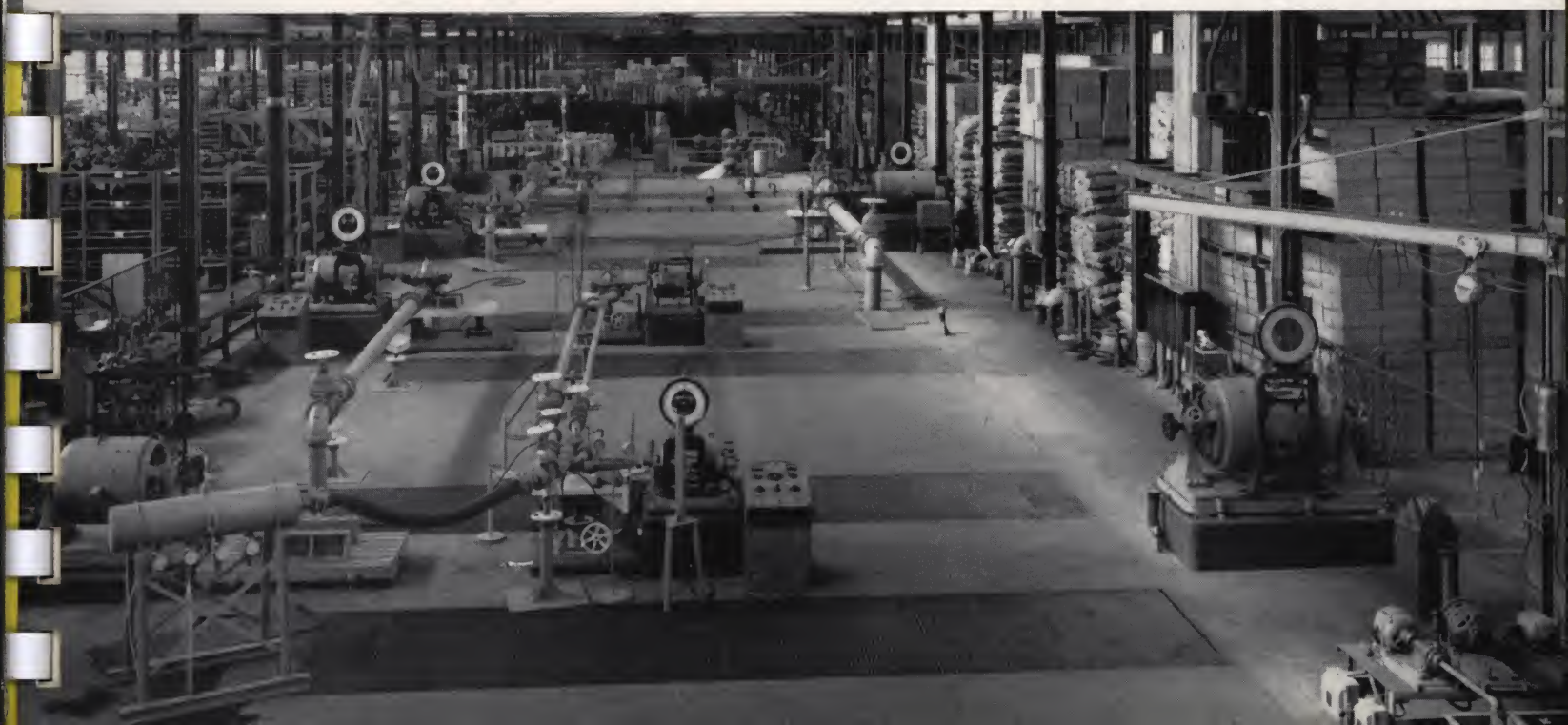
The test laboratory pit, with a capacity of 500,000 gallons, is said to be the largest in the country. Use of water from the test pit permits accuracy in readings, by avoiding the entraining of air in the water. Also the large volume accommodated avoids overheating of the water by recirculation. The test pit amply provides for the testing of a number of pumps of all descriptions, at the same time. On a basis of 20% recirculation of water, the pit provides up to 86,000 gallons per minute for large gallonage pump test operations.

Head measurements, up to 100 feet, can be made with a mercury column calibrated in feet of water. Beyond the 100-feet range, Bourdon type gages are used to measure discharge pressure in pounds per square inch. Mercury manometers are used on the suction side of horizontal pumps to obtain direct readings of the suction lift.

The horizontal cradle-mounted dynamometer equipment is extremely accurate, and appears as one of the outstanding features of this hydraulic laboratory. It is controlled by amplidynes with electronic controllers. Peerless is the first pump company to employ this type of control in pump laboratory procedure.

A separate enclosed fireproof and dustproof room houses the laboratory's motor-generator equipment. These generators produce direct current for the dynamometers. They are electronically regulated, in conjunction with the amplidynes, to insure constant and most accurate speed control.

Comprehensive pump testing facilities and an experimental shop are also maintained in Peerless' Los Angeles works, affording duplication of many of the procedures in the Indianapolis works.



USEFUL ENGINEERING DATA

DEFINITION OF PUMP TERMS

SETTING (vertical turbine pumps) is the nominal distance from the center line of the column pipe connection at the discharge head to the column pipe connection at the bowl assembly.

STATIC LEVEL is the vertical distance in feet from the center line of the discharge to the level of the free pool while no liquid is being drawn from the pool.

PUMPING LEVEL is the vertical distance in feet from the center line of the discharge to the level of the free pool while the specified liquid flow is being drawn from the pool.

DRAWDOWN is the difference, in feet, between the pumping level and the static level.

CAPACITY is the rate of flow of liquid measure per unit of time, usually gpm.

TOTAL HEAD (vertical turbine pumps) of an installed pump:

(Open Suction) is the sum of the pressure, in feet, at the center line of the discharge plus the vertical distance, in feet, from the center line of the discharge to the surface of the liquid pool.

(Closed Suction) is the sum of the pressure, in feet, at the center line of the discharge plus the vertical distance, in feet, from the center line of the discharge to the center line of a gage located directly below the suction case, minus the pressure reading of the gage, in feet.

LABORATORY HEAD (vertical turbine pumps) is the pressure, in feet, at the center line of the discharge plus the vertical distance, in feet, from the center line of the discharge to the surface of the test pool when the pump is installed with the minimum length of column and shaft.

TOTAL DYNAMIC HEAD (vertical type pumps) is the total head plus the velocity head $\frac{(V^2)}{(2g)}$ at the discharge flange minus the velocity head at the suction flange. When the pumping level is measured to the surface of the free pool in an open suction installation the velocity head at the suction flange is assumed to be zero. For definition of velocity head, see below.

INPUT HORSEPOWER is the horsepower supplied to the prime mover of an installed pump.

LABORATORY HORSEPOWER (vertical turbine pumps) is the horsepower supplied to the pump when the minimum length of line shaft is used.

TOTAL HORSEPOWER (vertical turbine pumps) is the horsepower supplied to the top shaft of an installed pump and is equal to the laboratory horsepower plus the power required to overcome the mechanical friction drag on the line shaft, plus the inertia of its mass.

OVER-ALL EFFICIENCY of a pump installation is the ratio of the output power to input power based on total head, capacity and input horsepower.

EFFICIENCY of an installed pump is the ratio of output power to input power based on total head, capacity and total horsepower.

LABORATORY EFFICIENCY of a pump is the ratio of output power to input power based on laboratory head, capacity and laboratory horsepower.

DYNAMIC EFFICIENCY of an installed pump is the ratio of output power to input power based on total dynamic head, capacity and total horsepower.

VELOCITY HEAD (h_v) is figured from the average velocity (V) obtained by dividing the discharge in cfs by the actual area of the pipe cross section in square feet and determined at the point of the gage connection. It is expressed by the formula:

$$h_v = \frac{V^2}{2g}$$

where

g is the acceleration due to gravity = 32.17 feet per second^2

and

V is average velocity in the pipe in feet per second.

SUCTION LIFT (h_s) exists when the total suction head is below atmospheric pressure. Suction lift, as determined on test, is the reading of a liquid manometer at the suction of the pump, converted to feet of liquid, and referred to datum, minus the velocity head at the point of gage attachment.

SUCTION HEAD (h_s) exists when the total suction head is above atmospheric pressure. Suction head, as determined on test, is the reading of a gage at the suction flange of the pump converted to feet of liquid and referred to datum, plus the velocity head at the point of gage attachment.

TOTAL DISCHARGE HEAD (h_d) is the reading of a pressure gage at the discharge of the pump, converted to feet of liquid and referred to datum, plus velocity head at the point of gage attachment.

TOTAL HEAD (H) is the measure of the energy increase per pound imparted to the liquid by the pump and is therefore the algebraic difference between the total discharge head and the total suction head. Total head, as determined on a test when suction lift exists, is the sum of the total discharge head and total suction lift; and when suction head exists, the total head is the total discharge head minus the total suction head.

NET POSITIVE SUCTION HEAD (NPSH) is the total suction head in feet of liquid absolute determined at the suction flange and referred to datum, less the vapor pressure of the liquid in feet absolute.

SYMBOLS AND ABBREVIATIONS

abs	absolute
ac	alternating current
amp	amperes
atm	atmosphere
bbl	barrel
bhp	brake horsepower
btu	British thermal units
°C	degrees centigrade
cfm	cubic feet per minute
cfs	cubic feet per second
cm	centimeters
deg	degrees
dia	diameter
eff	efficiency
Em	motor efficiency
Eo	over-all efficiency (Eo = Em × Ep)
Ep	pump efficiency
ehp	effective horsepower
evap	evaporation
°F	degrees Fahrenheit
fhp	friction horsepower
fpm	feet per minute
fps	feet per second
ft	feet
ft-lb	foot-pounds
gal	gallons
gpm	gallons per minute
gps	gallons per second
H	total head in feet
hp	horsepower
hp-hr	horsepower hour
hr	hours
in	inches
kva	kilovolt-amperes
kw	kilowatts
kwh	kilowatt-hours
lb	pound
max	maximum
min	minutes, minimum
mm	millimeters
press	pressure
psi	pounds per square inch
Q	capacity, gallons per minute
rpm	revolutions per minute
sec	seconds
shp	shaft horsepower
sp-gr	specific gravity
sq	square
std	standard
temp	temperature

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DETERMINATION OF PUMPING HEAD

The operating conditions of a pump should be determined as accurately as possible. If there is a variation in head, both maximum and minimum heads should be allowed for in the pump selection.

The total head developed by a pump, or **total dynamic head,** is made up of the following:

1. **Static Head.** The total change in elevation of the liquid, from suction level to discharge level, plus the pressure difference of suction and discharge reservoirs if different from atmospheric.
2. **Pipe Friction.** The friction head loss in the suction and discharge line, elbows and valves, and the suction pipe entrance loss.
3. **Velocity Head.** The velocity head at the end of the discharge pipe.

SYSTEM HEAD CURVES

In addition to knowing the head for the design capacity, it is, for many installations, desirable to know the piping system head-capacity characteristic. When operating conditions are variable, a plot of the system head curve imposed on the pump curves enables the best pump selection for the operating range.

In any piping system the pipe friction and velocity head varies with capacity. Thus, for any fixed static head conditions, the system head increases from static head at zero flow for any increase in capacity. Also, the static head may be variable. Then, the pipe friction and velocity head losses can be added separately to the maximum and minimum static heads, respectively, and the maximum and minimum system head curves can be plotted.

When the system curve is superimposed on the pump curve, the operating points are the intersections of the system curve with the pump curves. Thus the operating range for the pump is established and its suitability for the application is determined.

PUMPING LIQUIDS OTHER THAN WATER

HEAD

The head of a pump is generally expressed in feet and is so plotted on pump curves. This head developed, expressed in feet, is the same irrespective of the fluid pumped. However, the head expressed in pounds per square inch (psi) will be different for fluids of different specific gravity. The heavier the fluid the greater will be the head expressed in psi for a pump. The relation of feet head and psi are:

$$\frac{\text{ft x sp-gr}}{2.31} = \text{psi}$$

$$\frac{\text{psi x } 2.31}{\text{sp-gr}} = \text{ft}$$

HORSEPOWER

Pump horsepower is changed with any change in specific gravity. Pump horsepower curves, unless otherwise noted, are plotted for water, which has a specific gravity of 1.00 at normal temperatures. Any

increase or decrease in specific gravity will proportionately increase or decrease the horsepower. The general formula for calculating horsepower is:

$$\text{bhp} = \frac{\text{gpm x total head in feet}}{\text{3960 x efficiency}}$$

is based upon water, i.e., a specific gravity of 1.00. When the sp-gr is other than 1.00, the formula should be:

$$\text{bhp} = \frac{\text{gpm x total head in feet}}{\text{3960 x efficiency}} \text{ x sp-gr}$$

VISCOUS LIQUIDS

Centrifugal pumps can satisfactorily handle many oils and other viscous liquids. Applications of pumps to viscous liquids should be referred to the factory. When pumping viscous liquids centrifugal pump characteristics are radically altered. The pump head, capacity, and efficiency all decrease when pumping viscous liquids. The variation is more pronounced as the liquid becomes more viscous, and is not a linear function.

NPSH

(NET POSITIVE SUCTION HEAD)

A major problem encountered in many pumping applications, particularly those involving fluids at or near their boiling points, is a lack of net positive suction head (NPSH). Net positive suction head is the absolute pressure, above the vapor pressure of the fluid pumped, available at the entrance or eye of an impeller, to move and accelerate the fluid entering the eye. If the NPSH available in an installation is insufficient, the pump will cavitate and serious operational difficulties may develop. These troubles can include serious reduction in capacity and efficiency, excessive vibration, reduced life of pump parts due to cavitation erosion, and damage to the pump from possible vapor lock and running dry.

A centrifugal pump has a minimum required NPSH to prevent cavitation, which varies with capacity. This characteristic is inherent in the design of a pump and is just as much a performance characteristic as its head-capacity relationship. For a pump to operate cavitation free, the available NPSH of an installation must exceed the NPSH required by the pump for the operating conditions.

The NPSH required by a pump can be supplied by the pump manufacturer. It is expressed in feet of fluid pumped as is total head developed.

The system NPSH available in a proposed installation can be calculated by the formula:

$$H_{sv} = H_p \pm H_z - H_f - H_{vp}$$

Where:

H_{sv} = NPSH expressed in feet of fluid.

H_p = absolute pressure on the surface of the liquid where the pump takes suction, expressed in feet of fluid.

H_z = static elevation of the liquid above or below the centerline of the impeller (on vertical pumps the correction should be made to the entrance eye of the impeller) expressed in feet.

H_f = Friction and entrance head losses in the suction piping expressed in feet.

H_{vp} = absolute vapor pressure of fluid at the pumping temperature expressed in feet of fluid.

The system NPSH available in an existing installation can be measured as follows:

$$H_{sv} = P_a \pm P_s + \frac{V_s^2}{2g} - H_{vp}$$

Where:

P_a = atmospheric pressure for the elevation of the installation expressed in feet of fluid.

P_s = gage pressure at the suction flange of the pump corrected to the pump centerline and expressed in feet of fluid.

$\frac{V_s^2}{2g}$ = velocity head at the point of measurement of P_s.

H_{vp} = absolute vapor pressure expressed in feet of fluid.

NPSH as explained defines suction conditions of a pump installation and suction characteristic of a pump. Naturally, NPSH and suction lift are related for suction lift also indicates suction conditions. When the NPSH is known the suction lift can be determined by the formula:

$$H_s = H_p - H_{sv} - H_{vp} - H_f$$

Where:

H_s = total suction lift.

EFFECT ON CENTRIFUGAL PUMPS OF CHANGE OF SPEED OR SLIGHT CHANGE OF IMPELLER DIAMETER

H = head in feet. d = dia. of impeller

Total Head varies as the square of the speed or diameter:

$$H_2 = H_1 \left(\frac{\text{rpm}_2}{\text{rpm}_1}\right)^2 \text{ or } H_2 = H_1 \left(\frac{d_2}{d_1}\right)^2$$

Capacity varies directly as the speed or diameter:

$$\text{gpm}_2 = \text{gpm}_1 \text{ x } \frac{\text{rpm}_2}{\text{rpm}_1} \text{ or } \text{gpm}_2 = \text{gpm}_1 \text{ x } \frac{d_2}{d_1}$$

Brake horsepower varies as the cube of the speed or diameter:

$$\text{bhp}_2 = \text{bhp}_1 \text{ x} \left(\frac{\text{rpm}_2}{\text{rpm}_1}\right)^3 \text{ or } \text{bhp}_2 = \text{bhp}_1 \text{ x } \left(\frac{d_2}{d_1}\right)^3$$

FIELD TESTING METHODS

$$\text{Pump efficiency (water to water)} = \frac{\text{gpm} \times \text{total head in feet}}{3960 \times \text{brake hp to pump}}$$

$$\text{Field overall efficiency} = \frac{\text{gpm} \times \text{total head in feet}}{3960 \times \text{input hp to pump motor}}$$

TOTAL HEAD

VERTICAL TYPE PUMPS

Field pumping head consists of the measured distance from the water level in the well when pumping to the center of the discharge pipe, plus the total discharge head, including pipe friction above the center line of the discharge pipe.

When a pressure gage is used for determining the discharge head, including pipe friction, the total pumping head will consist of the distance from the water level in the well, when pumping, to the center of the discharge pressure gage, plus the discharge pressure gage reading, which will show the total discharge head, including the pipe friction beyond the discharge pressure gage. If the pressure gage measures in pounds per square inch, it should be converted to feet by multiplying by 2.31. When the pressure above the gage is relatively small, a glass tube and rubber hose connection is generally used to obtain the discharge head in view of the possible error in a low gage reading.

Standard methods of measuring the distance to the pumping water level consists of (a) direct measurement using a steel tape and a suitable float (b) direct measurement by using electric contact and insulated wire sounding line (c) air line using calibrated depth gage.

HORIZONTAL CENTRIFUGAL PUMPS

The total head for centrifugal pumps is the algebraic sum of the suction and discharge gage readings. See definitions, page 90.

CAPACITY MEASUREMENT (gpm)

The following are standard methods for measuring the rate of flow of pumped water:

(a) Volumetric calculation when pumping into accurately measured reservoirs or tanks.
(b) Calibrated Venturi meters.
(c) Triangular weir.
(d) Rectangular weir.
(e) Thin plate calibrated orifice.
(f) Calibrated pitot tube.

HORSEPOWER MEASUREMENT

Input horsepower to motor (see page 97 for meter method of determining input horsepower).

The input horsepower to motor is generally measured by existing watt-hour meter or by calibrated indicating watt meter or watt-hour meter.

BRAKE HORSEPOWER TO PUMP

Determination of the brake horsepower to the pump may be obtained by multiplying the input horsepower to the motor by the direct input-output efficiency of the specific make, rating and type of motor used, and not by the so-called "conventional efficiency." The following efficiencies can be used for approximate figures, in most standard induction motors:

5 hp to 10 hp, inclusive	85%
15 hp to 25 hp, inclusive	86%
30 hp to 50 hp, inclusive	87%
60 hp to 100 hp, inclusive	88%
75 hp to 200 hp, inclusive	89%
200 hp to 400 hp, inclusive	90%

In case absolute accuracy is required it is necessary to consult the motor manufacturer for the correct efficiency of the particular motor being used, specifying that it shall include all bearing and windage losses and shall be the directly measured efficiency. In order to compare the head, capacity or horsepower results directly with the manufacturer's pump characteristic curve, the exact pump speed should be obtained and correction for variation in speed be made pertaining to head, capacity and horsepower, in accordance with the formulae above.

If the pump is driven by means of a natural gas engine the power output of the engine varies, of course, according to its design and mechanical condition. An approximate average indicates 12,000 btu are required per horsepower. If for example, the meter indicates a fuel consumption of 10 cubic feet of gas per minute then the power output of the engine (for modern equipment in good mechanical condition) would be 50 hp. Thus, assuming 1000 btu per cubic foot of natural gas:

$1000 \times 10 \times 60 = 600{,}000$ btu per hour or:

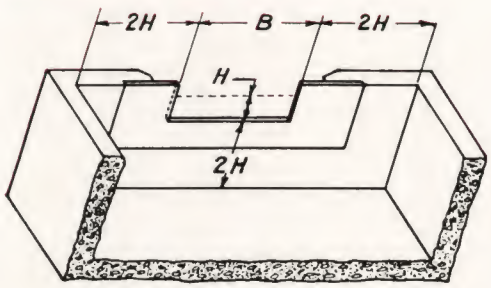
$$\frac{600{,}000}{12{,}000} = 50 \text{ hp}$$

If the pump is driven by means of a long quarter turn flat belt with or without idler, the horsepower required to drive the pump, (as apparent from the horsepower output from the prime mover), should be reduced by the amount of loss in the belted drive, by multiplying by the expected loss in percent. Belt loss varies generally from 8% to 12% according to the particular set-up.

Example: hp to pump shaft = hp (output of prime mover) $\times$.90 (if arrangement is such that there is a 10% loss).

RECTANGULAR WEIR

WITH COMPLETE END CONTRACTIONS



FRANCIS FORMULA:

Discharge in gallons per minute $= 1494.6 \times (B - .2H) \times H^{3}/_{2}$.

H = Height, in feet, of water above weir. H should be measured a distance upstream from the weir of at least 4 times H.

B = At least 3 H.

The weir should be set with its crest level and its plane vertical. For greatest accuracy and long service, the weir plate should be made of stainless steel and set flush with the inside of the wall. The sides and the crest of the plate should be beveled on the outside so that the thickness at the opening does not exceed 1/16". The inside edge must be smooth and sharp, as any rounding of the edge will increase the discharge for a given head.

Weir tables showing the discharge in gpm follow:

WEIR TABLE*

DISCHARGE IN U.S. GALLONS PER MINUTE OVER RECTANGULAR WEIR WITH COMPLETE CONTRACTIONS

HEAD		LENGTH OF WEIR					
Inch	Feet	1 Ft.	2 Ft.	3 Ft.	4 Ft.	5 Ft.	Addition for 1 Ft. Increase in Length
2″	0.167	98.9	200.5	302.	404.	506.	102.
2 1/16″	0.172	103.	210.	316.	422.8	530.	106.8
2 1/8″	0.177	107.8	219.9	332.	443.7	555.	111.7
2 3/16″	0.182	112.4	229.	345.	461.6	579.	116.6
2 1/4″	0.187	117.	239.	361.	482.3	605.	121.3
2 5/16″	0.193	122.5	249.	376.	503.	629.	127.
2 3/8″	0.198	127.	259.	390.5	523.	655.	132.
2 7/16″	0.203	132.	269.	406.	543.	680.	137.2
2 1/2″	0.208	137.	279.	422.	564.9	706.	142.9
2 9/16″	0.213	142.	289.	438.	586.	732.	148.
2 5/8″	0.219	147.1	300.	453.	607.	760.	153.5
2 11/16″	0.224	151.4	310.5	470.	629.	785.	159.
2 3/4″	0.229	157.	321.5	485.	649.2	815.	164.2
2 13/16″	0.234	162.	332.	501.5	672.	832.5	170.15
2 7/8″	0.240	168.	343.	520.	695.3	870.	175.3
2 15/16″	0.245	173.	354.	535.	716.4	898.	181.4
3″	0.250	178.	366.	552.	739.3	926.	187.3
3 1/16″	0.255	183.	377.	569.	763.	956.	193.5
3 1/8″	0.260	189.1	388.	588.	787.2	986.	199.2
3 3/16″	0.266	194.	400.	605.	811.	1015.	205.5
3 1/4″	0.271	199.	410.5	624.	835.	1047.	211.
3 5/16″	0.276	205.6	422.	640.	858.	1076.	217.6
3 3/8″	0.281	210.8	435.	659.	883.	1105.	224.
3 7/16″	0.286	216.5	446.	676.	906.	1138.	229.8
3 1/2″	0.292	222.8	458.	695.	931.15	1167.	236.15
3 9/16″	0.297	228.	470.	714.	956.2	1200.	242.2
3 5/8″	0.302	234.	483.	731.	980.4	1230.	249.4
3 11/16″	0.307	240.	495.	750.	1005.9	1260.	255.9
3 3/4″	0.312	245.	506.	769.	1031.2	1292.	262.2
3 13/16″	0.318	251.	520.	789.	1058.	1328.	268.6
3 7/8″	0.323	256.5	533.	808.	1089.	1355.	274.5
3 15/16″	0.328	263.	545.	825.	1107.	1390.	282.
4″	0.333		556.	846.	1134.	1424.	288.
4 1/16″	0.338		570.	866.	1162.	1454.	296.
4 1/8″	0.344		584.	885.	1186.9	1490.	301.9
4 3/16″	0.349		596.	907.5	1215.	1518.	309.
4 1/4″	0.354		610.	925.	1241.	1553.	316.
4 5/16″	0.359		623.	945.	1268.	1590.	323.
4 3/8″	0.365		636.	966.	1297.	1628.	330.5
4 7/16″	0.370		650.	986.	1323.	1660.	336.8
4 1/2″	0.375		663.	1006.	1350.	1696.	344.
4 9/16″	0.380		676.	1030.	1382.	1730.	351.5
4 5/8″	0.385		690.	1050.	1408.	1768.	358.
4 11/16″	0.390		704.	1069.	1435.	1801.	366.
4 3/4″	0.396		717.5	1091.	1465.	1835.	374.
4 13/16″	0.401		731.	1111.	1492.	1875.	380.9
4 7/8″	0.406		744.5	1131.	1519.	1908.	388.2
4 15/16″	0.411		759.	1156.	1551.9	1948.	395.9
5″	0.417		772.	1175.	1579.3	1985.	404.3
5 1/16″	0.422		785.	1200.	1611.5	2018.	410.5
5 1/8″	0.427		800.	1220.	1639.	2056.	419.4
5 3/16″	0.432		815.	1239.	1665.	2094.	426.
5 1/4″	0.437		830.	1262.	1696.4	2130.	434.4
5 5/16″	0.443		844.	1285.	1726.	2168.	441.
5 3/8″	0.448		857.	1310.	1760.	2208.	450.
5 7/16″	0.453		871.	1330.	1787.5	2243.	457.5
5 1/2″	0.458		887.	1352.	1817.5	2282.	465.5
5 9/16″	0.463		903.	1376.	1846.9	2321.	470.9
5 5/8″	0.469		915.	1395.	1875.	2358.	480.
5 11/16″	0.474		932.5	1419.	1907.	2400.	487.6
5 3/4″	0.479		947.5	1442.	1937.	2440.	495.
5 13/16″	0.484		960.	1465.	1968.5	2480.	503.5
5 7/8″	0.490		977.	1490.	2001.	2515.	511.
5 15/16″	0.495		993.	1515.	2034.	2559.	519.6
6″	0.500		1005.	1535.	2063.	2600.	528.
6 1/16″	0.505		1021.	1561.	2097.	2640.	536.
6 1/8″	0.510		1039.	1582.	2125.	2675.	543.
6 3/16″	0.515		1051.	1609.	2163.	2716.	554.
6 1/4″	0.521		1068.	1632.	2192.	2760.	560.
6 5/16″	0.526		1083.	1655.	2225.	2801.	570.
6 3/8″	0.531		1100.	1679.	2254.	2844.	575.
6 7/16″	0.536		1112.	1704.	2290.	2881.	586.
6 1/2″	0.542		1130.	1742.	2338.	2920.	596.
6 9/16″	0.547		1147.	1760.	2362.	2962.	602.3
6 5/8″	0.552		1161.	1779.	2392.8	3005.	613.8
6 11/16″	0.557		1178.	1803.	2422.	3047.	617.8
6 3/4″	0.563		1193.	1826.	2455.9	3094.	629.9
6 13/16″	0.568		1210.	1853.	2493.	3139.	640.
6 7/8″	0.573		1226.	1878.	2523.5	3180.	645.5
6 15/16″	0.578		1240.	1903.	2559.	3219.	656.
7″	0.583		1258.	1928.	2596.	3260.	668.
7 1/16″	0.589		1272.	1949.	2621.5	3300.	672.5
7 1/8″	0.594		1290.	1976.	2658.	3342.	682.5
7 3/16″	0.599		1309.	2000.	2695.	3384.	695.
7 1/4″	0.604		1322.	2029.	2730.5	3436.	701.5
7 5/16″	0.609		1339.	2058.	2768.	3480.	710.
7 3/8″	0.615		1356.	2080.	2799.6	3522.	719.6
7 7/16″	0.620		1371.	2105.	2834.	3570.	729.
7 1/2″	0.625		1390.	2130.	2866.	3609.	736.
7 9/16″	0.630		1408.	2155.	2901.	3658.	746.
7 5/8″	0.635		1423.	2179.	2934.	3700.	755.
7 11/16″	0.641		1439.	2212.	2976.	3745.	764.
7 3/4″	0.646		1458.	2238.	3012.	3785.	774.
7 13/16″	0.651		1471.	2260.	3042.	3820.	782.
7 7/8″	0.656		1490.	2286.	3078.	3860.	792.
7 15/16″	0.661		1506.	2310.	3113.	3903.	803.
8″	0.667			2338.	3151.5	3956.	813.5
8 1/16″	0.672			2365.	3186.5	4000.	821.5
8 1/8″	0.677			2396.	3227.	4045.	831.
8 3/16″	0.682			2419.	3259.	4090.	840.
8 1/4″	0.688			2442.	3292.	4140.	850.
8 5/16″	0.693			2460.	3320.	4178.	860.
8 3/8″	0.698			2493.	3364.	4227.	871.
8 7/16″	0.703			2516.	3395.6	4272.	879.6
8 1/2″	0.708			2540.	3430.	4312.	889.7
8 9/16″	0.714			2570.	3469.	4362.	899.
8 5/8″	0.719			2595.	3504.	4415.	909.
8 11/16″	0.724			2626.	3545.	4460.	919.
8 3/4″	0.729			2656.	3585.	4511.	929.
8 13/16″	0.734			2680.	3620.	4552.	940.
8 7/8″	0.740			2705.	3654.	4600.	949.
8 15/16″	0.745			2739.	3698.	4648.	959.
9″	0.750			2765.	3734.5	4699.	969.5
9 1/16″	0.755			2792.	3771.	4749.	979.
9 1/8″	0.760			2816.	3811.	4799.	995.
9 3/16″	0.765			2844.	3843.	4849.	999.
9 1/4″	0.771			2876.	3887.	4899.	1011.
9 5/16″	0.776			2901.	3921.	4949.	1020.
9 3/8″	0.781			2927.	3958.	4999.	1031.
9 7/16″	0.786			2960.	4001.	5049.	1041.
9 1/2″	0.792			2985.	4036.	5098.	1051.
9 9/16″	0.797			3017.	4077.	5145.	1060.
9 5/8″	0.802			3041.	4113.	5185.	1072.
9 11/16″	0.807			3073.	4155.	5227.	1082.
9 3/4″	0.812			3101.	4192.	5288.	1091.
9 13/16″	0.818			3131.	4234.	5340.	1103.
9 7/8″	0.823			3160.	4273.	5393.	1112.
9 15/16″	0.828			3190.	4315.	5443.	1125.
10″	0.833			3216.	4352.	5490.	1136.

EXAMPLE:

Suppose that after the water has been flowing for some time over a 2-foot weir the head or depth of flow is found to be 6⅛″. To find the number of gallons per minute flowing over the weir, follow the "Head" column down to 6⅛″ and then crosswise to column marked "2 Ft." There the flow is found to be 1039 gallons per minute.

The depth of flow should be measured at a point at least four feet back of the weir plate as the depth over the weir crest is considerably less than at this point.

*Based on Francis Formula with full end contractions.

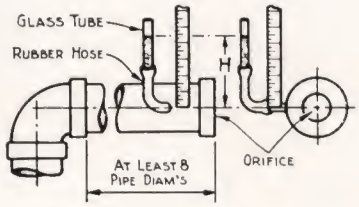
ORIFICE CHARTS
and
Pipe Weights and Dimensions

MEASUREMENT OF WATER BY CIRCULAR ORIFICE AT END OF DISCHARGE PIPE

To obtain an accurate result in measuring the flow of water with a circular orifice, the following conditions are to be maintained: Pipe must be horizontal with no elbows, obstructions or bends within 8 pipe diameters of discharge end; the orifice must be running full of water and "H" be at least one inch above top of the pipe.

Drill and tap discharge pipe on the side through center line for ⅛" pipe connection one foot back from orifice. It is very important that the ⅛" nipple does not extend inside the inner wall of the pipe and should be absolutely flush.

When the rubber hose connection and the glass tube are installed, "H" may be measured from the center of the pipe with an ordinary rule.

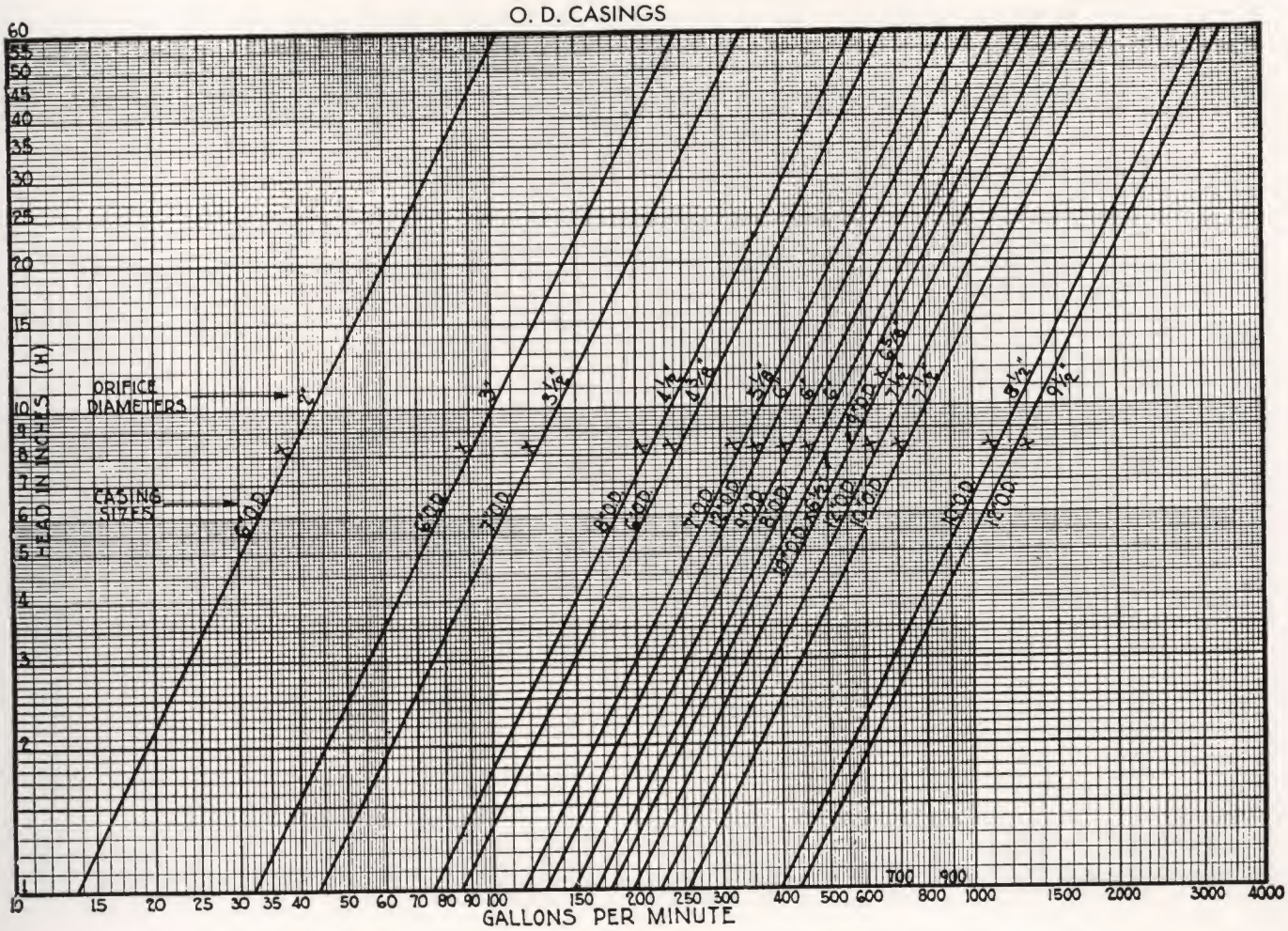


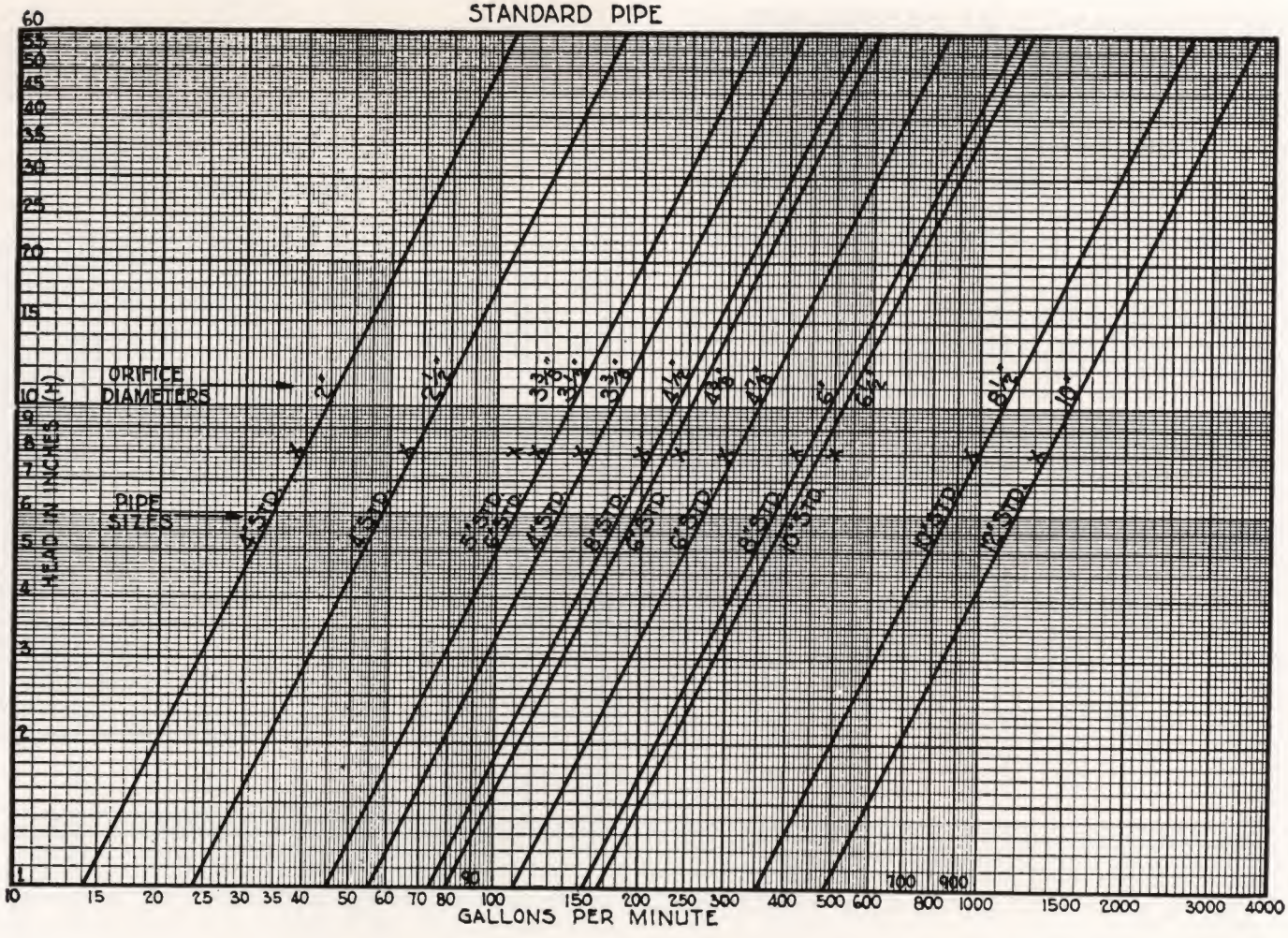
EXTRA STRONG PIPE

All weights and dimensions are nominal

Size	Weight per foot plain ends	Thick-ness	Diameters		Test pressure		
			External	Internal	Butt-welded	Lap-welded	Seam-less
Ins.	Lbs.	Ins.	Ins.	Ins.	Lbs. per sq. in.		
⅛	.31	.095	.405	.215	700		1000
¼	.54	.119	.540	.302	700		1000
⅜	.74	.126	.675	.423	700		1000
½	1.09	.147	.840	.546	700		1000
¾	1.47	.154	1.050	.742	700		1000
1	2.17	.179	1.315	.957	700		1000
1¼	3.00	.191	1.660	1.278	1500		2500
1½	3.63	.200	1.900	1.500	1500		2500
2	5.02	.218	2.375	1.939	1500	2500	2500
2½	7.66	.276	2.875	2.323	1500	2000	2500
3	10.25	.300	3.500	2.900	1500	2000	2500
3½	12.51	.318	4.000	3.364		2000	2500
4	14.98	.337	4.500	3.826		2000	2200
5	20.78	.375	5.563	4.813		1800	2000
6	28.57	.432	6.625	5.761		1800	2000
8	43.39	.500	8.625	7.625		1500	1700
10	54.74	.500	10.750	9.750		1200	1400
12	65.42	.500	12.750	11.750		1100	1100

The permissible variation in weight is 5 per cent above and 5 per cent below.





STANDARD PIPE

All weights and dimensions are nominal

Size	Weight per foot		Pipe			Threads per inch	Couplings			Test pressure		
	Threads and couplings	Plain ends	Thickness	Diameters			Length	External diameter	Weight	Butt-welded	Lap-welded	Seamless
				External	Internal							
Ins.	Lbs.	Lbs.	Ins.	Ins.	Ins.		Ins.	Ins.	Lbs.	Lbs. per sq. in.		
⅛	.24	.24	.068	.405	.269	27	⅜	.563	.03	700		1000
¼	.42	.42	.088	.540	.364	18	1⅜	.719	.07	700		1000
⅜	.57	.57	.091	.675	.493	18	1⅜	.875	.09	700		1000
½	.85	.85	.109	.840	.622	14	1⅜	1.063	.17	700		1000
¾	1.13	1.13	.113	1.050	.824	14	1⅝	1.313	.24	700		1000
1	1.68	1.68	.133	1.315	1.049	11½	2	1.576	.38	700		1000
1¼	2.28	2.27	.140	1.660	1.380	11½	2⅛	1.900	.44	700		2500
1½	2.73	2.72	.145	1.900	1.610	11½	2⅛	2.200	.60	700		2300
2	3.67	3.65	.154	2.375	2.067	11½	2⅜	2.750	.93	700	1000	1900
2½	5.81	5.79	.203	2.875	2.469	8	3⅛	3.250	1.82	800	1000	2100
3	7.61	7.58	.216	3.500	3.068	8	3¼	4.000	2.98	800	1000	1900
3½	9.20	9.11	.226	4.000	3.548	8	3⅜	4.625	4.20	...	1000	1700
4	10.88	10.79	.237	4.500	4.026	8	3½	5.000	4.51	...	1000	1600
5	14.81	14.62	.258	5.563	5.047	8	3¾	6.296	8.25	...	1000	1500
6	19.18	18.97	.280	6.625	6.065	8	4	7.390	10.88	...	1000	1500
8	25.00	24.70	.277	8.625	8.071	8	5¼	9.625	23.46	...	800	1000
8	28.80	28.55	.322	8.625	7.981	8	5¼	9.625	23.46	...	1000	1200
10	32.00	31.20	.279	10.750	10.192	8	5¾	11.750	32.02	...	600	800
10	35.00	34.24	.307	10.750	10.136	8	5¾	11.750	32.02	...	800	900
10	41.13	40.48	.365	10.750	10.020	8	5¾	11.750	32.02	...	900	1000
12	45.00	43.77	.330	12.750	12.090	8	6⅛	14.000	49.92	...	600	800
12	50.70	49.56	.375	12.750	12.000	8	6⅛	14.000	49.92	...	800	900

The permissible variation in weight is 5 per cent above and 5 per cent below.

Formulae for Determining

COST OF ELECTRICAL PUMPING

With efficiency of pump and motor known, proportionate cost of power can be predetermined on a basis common to all pumps, regardless of size or capacity. By using units of capacity and head, comparisons can be made in pumps having different capacities.

Power cost of pumping varies inversely with overall plant efficiency (Eo). Thus, power cost per gallon for each foot head on a pump of 30% overall plant efficiency is double that of a pump of 60% overall plant efficiency. (Assuming power rate the same in both cases.)

To pump one gallon of water in one minute (1 gpm) against one foot head with 100% overall plant efficiency, requires .000189 kilowatts. Pumping 1000 gallons per minute (1000 gpm) per foot head at 100% (Eo) requires .189 kilowatts.

The following formulae can be used for determining power costs of pumping under any conditions:

COST PER 1000 GALLONS

(not gallons per minute) for each foot of head

$$= \frac{.00315 \times R}{Eo} \quad \text{or} \quad \frac{.189 \times R}{Ep \times Em \times 60}$$

Where:
- .189 = Theoretical kw as stated above.
- R = Power cost per kwh.
- Ep = Pump efficiency.
- Em = Motor efficiency.
- Eo = Overall plant efficiency.
- 60 = Minutes.

Example: Find the cost per 1000 gallons (not gpm) per foot head, of a pumping plant whose overall plant efficiency (Eo) is 60% (.60), power rate, nine mills ($.009) per kwh. Substituting in formula:

Cost per 1000 gallons per foot head =

$$\frac{.00315 \times .009}{.60} = \frac{.00002835}{.60} = \$.00004725$$

If the pump is lifting water over a 120-foot head, then the cost per 1000 gallons (not gpm) delivered would be:

$$\$.00004725 \times 120 = \$.00567.$$

Pumping costs per any given condition of capacity or head may be determined by using the following formula:

COST PER HOUR

$$= \frac{.000189 \times \text{gpm} \times \text{Total Head} \times \text{Power Rate}}{\text{Overall Plant Effciency}}$$

Example: Find the cost per hour of a pump delivering 500 gpm against a 120-foot head, overall plant efficiency of pump 60% (.60), power rate nine mills ($.009) per kwh.

Substituting in formula we have:

$$\text{Cost per hour} = \frac{.000189 \times 500 \times 120 \times .009}{.60}$$

$$= 17 \text{ cents}$$

COST PER ACRE-FOOT

$$= \frac{1.023 \times \text{Total Head} \times \text{Power Rate}}{Eo}$$

Example: Find the cost per acre-foot of a pump delivering 500 gpm against a 120-foot head, overall plant efficiency of pump 60% (.60), power rate nine mills ($.009) per kwh. Substituting in formula:

$$\text{Cost per acre-foot} = \frac{1.023 \times 120 \times .009}{.60}$$

$$= \$1.8414.$$

$$\text{Kilowatt Hours Required per 1000 Gallons} = \frac{\text{kw} \times 16.66}{\text{gpm}}$$

kw = Kilowatts input to meter, based on plant efficiency (wire to water).

kw = hp to pump × .746, based on pump efficiency (water to water).

$$\text{Pump efficiency} = \frac{\text{gpm} \times \text{head}}{3960 \times \text{bhp (to pump)}}$$

1 Horsepower { = 33,000 ft lbs per minute; = 550 ft lbs per second; = 0.746 kw }

bhp to pump = motor efficiency × hp at meter.

H. P. AT METER

(DISK CONSTANT METHOD)

$$\text{hp (at meter)} = \frac{R \times K \times M}{.2072 \times t}$$

R = Rev. of disk.

K = Disk constant. Do not confuse disk constant with dial constant. Dial constant is not used to calculate meter horsepower. The disk constant is the watt hours per revolution of disk and can usually be found either on the nameplate or painted on the face of the disk.

M = Multiplier = Ratio of current transformers used to rating of meter. When current and potential transformers are used M equals the product of the current transformer ratio times the potential transformer ratio. If neither type of transformer is used there is no multiplier required in the above formula. (M = 1)

Example: (No current or potential transformers used.) Generally the meter nameplate states what the multiplier is if the size of the motor requires that transformers be used.

Disk K = 4.8 Turning 20 revolutions in 54.5 seconds.

$$\text{hp at meter} = \frac{20 \times 4.8}{.2072 \times 54.5} = 8.5 \text{ hp}$$

Example: (Current transformers used.)

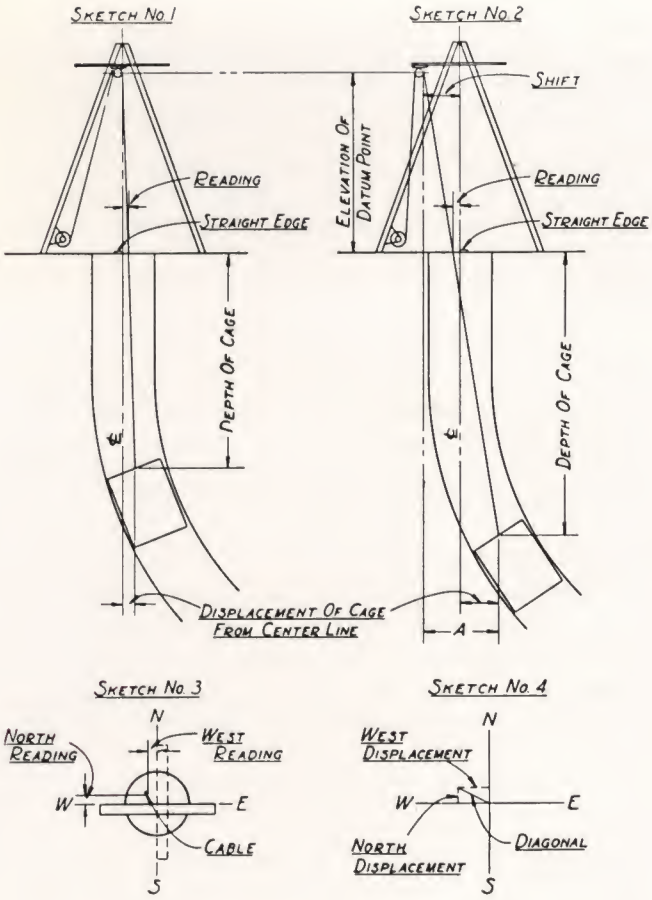
Disk K = 4.8 Turning 20 revolutions in 54.5 seconds.

Multiplier = M = 10

$$\text{hp at meter} = \frac{20 \times 4.8 \times 10}{.2072 \times 54.5} = 85.0 \text{ hp}$$

The term "Efficiency" as used in pumping would be of no practical value if it could not be reduced to terms of actual pumping costs, expressed in dollars.

A SIMPLE METHOD OF SURVEYING A DEEP WELL



1) PURPOSE OF SURVEYING A WELL—It is advantageous to know whether or not a pump will fit in a well and operate normally. Since the pump column can be curved, within limits, without being detrimental to pump operation, a well is surveyed to find out in what directions and how sharply it curves throughout its length.

2) EQUIPMENT NECESSARY—The equipment to be used is listed below.

(a) A reel of small steel cable long enough to reach to the desired depth.

(b) A cage about two feet long with an adjustable diameter or a diameter about ¼" smaller than the ID of the well casing.

(c) A small pulley for the steel cable, having a frame which can be bolted to a board.

3) EQUIPMENT SET-UP—Attach the pulley to a board thick enough to carry the weight of the cage and line without bending. Support the board horizontally at least ten feet above the top of the well casing. The board and supports should be arranged so that the location of the pulley can be shifted at least two feet in any horizontal direction by sliding the board. A derrick is the most convenient support, but if there is no derrick a tripod or other structure must be constructed.

Run the cable through the pulley and attach the end to the center of the cage. Hang the cage slightly above the well casing and move the pulley until the axis of the cage is in line with the center of the well.

Next, establish with a straightedge four marks on the well casing or floor which can be used to determine two horizontal lines at right angles to each other, passing as near to the center of the well as the cable will permit without the cable being deflected from its center position. To simplify the procedure, one of these lines should be parallel to the board carrying the pulley. Usually the lines are laid off as North-South and East-West lines.

4) CAGE POSITION READINGS—Lower the cage ten feet at a time and measure deflections in the North, South, East or West directions from the center, as shown in Sketch No. 3, at each ten-foot interval. The vertical distance of the center of the pulley above the level of the place where deflection measurements are made must also be measured. The center of the pulley is called the datum point.

Sketch No. 1 shows an elevation of a well with a cage in the well, and Sketch No. 3 shows a plan view of the top of the well with a straightedge in its two positions. In making the measurements indicated, it must be remembered that the straightedge was located by the side of the cable instead of the center. Since the cable was in the center of the well, the straightedge does not lie exactly on a diameter and deflections must always be measured on the same sides of the cable that determined the North-South and East-West lines.

5) SHIFTING THE DATUM POINT—The cable must not be touching the side of the well casing when readings are taken. By referring to Sketch No. 1 it is evident that if the well is crooked the cable can touch the well casing when the cage is lowered past a bend or spiral. When the cable touches the casing, any readings beyond this point are valueless. It is necessary to shift the datum point so that the cable will not touch the casing. If the crook is above the water level, this condition can be observed. If it is below the water level, it may be suspected if the location of the cable remains constant as the cage is lowered. It occasionally happens, however, that the well is actually slanting or curving so that it will give a constant reading for a while and, since shifting the pulley is apt to introduce errors unless great care is used, it is best to be sure that the cable is touching before any shifts are made. If the well is so crooked that the cable touches at a second point after being shifted, it is impossible to survey it beyond this point by this method.

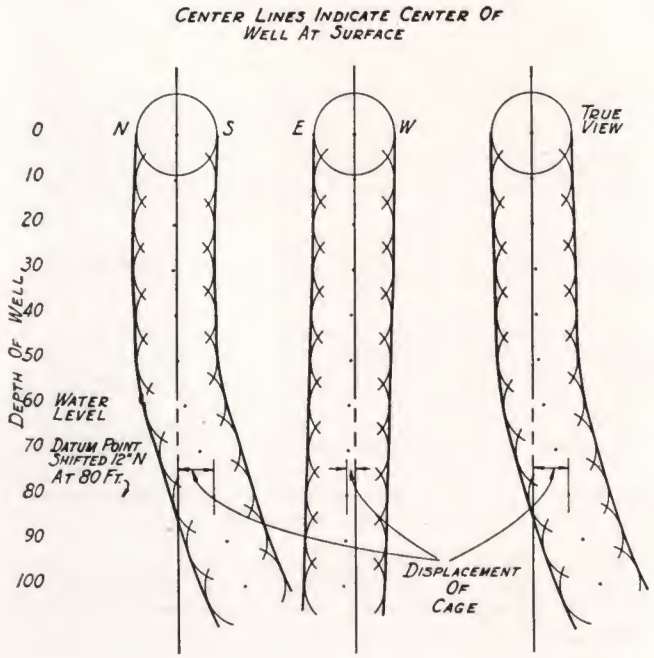
If the data is worked up and plotted, it is possible to see whether or not any of the above difficulties are present. Usually, a shift in one direction will be suffi-

cient, but sometimes it is necessary to shift in the other direction also. The pulley should be shifted as far as the surveyor deems necessary and for every shift it is important that the position (vertically and in both directions horizontally) of the datum point be acurately determined. Sketch No. 2 shows a well being surveyed with the datum point shifted.

6) PLOTTING THE CAGE POSITIONS—After the data has been calculated it should be plotted on graph paper. The deflections for the true view are determined graphically by drawing the diagonals of parallelograms produced by plotting the displacement readings as shown in Sketch No. 4. Cross-section paper with one-inch squares, divided into ten smaller squares to the inch, is convenient for laying out the wells. If the depth is laid out with ten feet to the inch and the cage displacement with ten inches to the inch, it usually results in a satisfactory representation of the well. The horizontal scale should be large enough to show the defects in the well clearly, but at the same time it must be recognized that unless the well diameter is plotted to exactly the same scale as the side deflection, the well plot will be misleading and of practically no value.

On the plot a straightedge can be used to represent the cable and to indicate whether or not the cable was touching the casing at any point.

If it is determined from the plot that the cable probably did not touch the well casing at any of the readings, during the survey, it is an indication that the readings were accurate. In order to determine what size of column pipe and bowl diameter can be safely operated in the well, construct from cardboard a cross-section of the column and bowl unit to the same scale as was used in plotting the survey. If the model of column and bowl unit can be placed in the well without binding on the well casing, when inserted on the plot of the true view of the survey, it is a good indication that the actual pump will do likewise.



SAMPLE DATA, CALCULATIONS AND PLOT

18" WELL

Elevation of datum point 20 ft. Water level 60 ft.
Datum Point shifted 12" North at 80 ft.

Depth Cage Feet	Readings of Deflections of Cable Inches				Displacement of Cage Inches			
	N	S	E	W	N	S	E	W
10	.1				.15			
20	.15		.1		.3		.2	
30	.2		.2		.5		.5	
40	.1		.3		.3		.9	
50			.35				1.25	
60		.5	.37			.2	1.48	
70		1.1	.4			6.75	1.8	
80	8.		.4			8.	2.	
90	7.8		.42			11.1	2.3	
100	7.5		.44			15.	2.64	

FORMULAE

No. 1 Displacement of cage from center line =

$$\text{Reading} \times \frac{(\text{depth of cage} + \text{El. of Datum})}{\text{El. of Datum}}$$

Sample Calculation at 10 ft. depth:

$$\text{Cage displacement} = \frac{.1 \times (10 + 20)}{20} = .15''$$

No. 2 Displacement of cage from center line when datum point is shifted =

$$^{*}(\text{shift} \pm \text{reading}) \times \frac{(\text{Cage Depth} + \text{El. of Datum})}{\text{El. of Datum}} - \text{shift}$$

*Add the reading to the shift when shift and reading are on opposite sides of center line; subtract when shift and reading are on same side of center line.

Sample Calculation at 80 ft. depth:

$$\text{Cage displacement} = (12 - 8) \times \frac{(80 + 20)}{20} - 12 = 8''$$

Since distance A (see Sketch No. 2) is greater than the shift, it is evident that the cage displacement is south from the center line.

Formula No. 1 is used in all EAST calculations in this case, but if there is a shift in the East-West direction, Formula No. 2 would have to be used in the same manner as for the North-South direction.

ELECTRICAL FORMULAE

REQUIRED	DIRECT CURRENT	ALTERNATING CURRENT	
		Single-phase	3-phase
Amperes when hp is known	$\frac{746\ (hp)}{(E)\ (eff)}$	$\frac{746\ (hp)}{(E)\ (eff)\ (pf)}$	$\frac{746\ (hp)}{1.73\ (E)\ (eff)\ (pf)}$
Amperes when kilowatts are known	$\frac{1000\ (kw)}{E}$	$\frac{1000\ (kw)}{(E)\ (pf)}$	$\frac{1000\ (kw)}{1.73\ (E)\ (pf)}$
Amperes when kva is known		$\frac{1000\ (kva)}{E}$	$\frac{1000\ (kva)}{1.73\ (E)}$
Kilowatts	$\frac{(I)\ (E)}{1000}$	$\frac{(E)\ (I)\ (pf)}{1000}$	$\frac{1.73\ (I)\ (E)\ (pf)}{1000}$
kva		$\frac{(I)\ (E)}{1000}$	$\frac{1.73\ (I)\ (E)}{1000}$
Horsepower Output	$\frac{(I)\ (E)\ (eff)}{746}$	$\frac{(I)\ (E)\ (pf)\ (eff)}{746}$	$\frac{1.73\ (I)\ (E)\ (pf)\ (eff)}{746}$

I = amperes
E = volts
eff = efficiency (as a decimal)
hp = horsepower
pf = power factor
kw = kilowatts
kva = kilovolt amperes

The following tabulation shows the approximate effects of variations in voltage and frequency on motor characteristics. These values should in no way be considered as guarantees.

MOTOR CHARACTERISTICS

General purpose open motors (drip-proof) are designed to give the best operation at their normal voltage and frequency (this information included on motor nameplate).

Some variation from normal is allowable, the voltage limits being approximately plus or minus 10% and the frequency limits plus or minus 5%. The voltage and frequency should never be varied simultaneously in opposite directions, and both should not be varied at the same time to the extreme limits allowed.

These motors will operate with an ambient temperature of 40° C. (surrounding temperature 104° F.) with a temperature rise of 40° C. (rise of 72° F.) when carrying the rated load at an altitude of not over 3300 feet.

These same motors are capable of carrying a 15% overload continuously providing the total temperature rise does not exceed 50° C. (122° F.). However, the total temperature cannot exceed 90° C., and thus if the ambient temperature is 122° F. this 15% service factor cannot be used. When operating a motor above 3300 feet the motor temperature rise increases approximately 1% for each 330 feet rise and this must be allowed for in computing the total allowable temperature rise.

SYNCHRONOUS AND FULL LOAD SPEED OF INDUCTION MOTORS—220-440 VOLTS

Number of Poles	50 Cycle		60 Cycle	
	Synch. Speed	Full Load Speed	Synch. Speed	Full Load Speed
2	3000	2900	3600	3460
4	1500	1460	1800	1760
6	1000	970	1200	1160
8	750	730	900	870
10	600	585	720	700
12	500	485	600	580
14	428	420	514	500

	Characteristic	Alternating-current (Induction) Motors			
		Voltage		Frequency	
		110%	90%	105%	95%
Torque*	Starting and Max Running	Increase 21%	Decrease 19%	Decrease 10%	Increase 11%
Speed†	Synchronous	No change	No change	Increase 5%	Decrease 5%
	Full Load	Increase 1%	Decrease 1.5%	Increase 5%	Decrease 5%
	Per Cent Slip	Decrease 17%	Increase 23%	Little change	Little change
Efficiency	Full Load	Increase 0.5 to 1 Point	Decrease 2 Points	Slight increase	Slight decrease
	¾ Load	Little change	Little change	Slight increase	Slight decrease
	½ Load	Decrease 1 to 2 Points	Increase 1 to 2 Points	Slight increase	Slight decrease
Power Factor	Full Load	Decrease 3 Points	Increase 1 Point	Slight increase	Slight decrease
	¾ Load	Decrease 4 Points	Increase 2 to 3 Points	Slight increase	Slight decrease
	½ Load	Decrease 5 to 6 Points	Increase 4 to 5 Points	Slight increase	Slight decrease
Current	Starting	Increase 10 to 12%	Decrease 10 to 12%	Decrease 5 to 6%	Increase 5 to 6%
	Full Load	Decrease 7%	Increase 11%	Slight decrease	Slight increase
Temperature Rise	ac Motors	Decrease 3 to 4° C	Increase 6 to 7° C	Slight decrease	Slight increase
	Maximum Overload Capacity	Increase 21%	Decrease 19%	Slight decrease	Slight increase
	Magnetic Noise	Slight increase	Slight decrease	Slight decrease	Slight increase

* The starting and maximum running torque of ac induction motors will vary as the square of the voltage.

† The speed of ac induction motors will vary directly with the frequency.

MOTOR WIRING DATA

From National Electrical Code

3-PHASE SQUIRREL-CAGE INDUCTION MOTORS

	220-Volt				440-Volt			
hp	Full Load (amp)	†Min. Size Wire AWG	Size Conduit (inches)	#Max. Rating of Branch Circuit Fuses	Full Load (amp)	†Min. Size Wire AWG	Size Conduit (inches)	#Max. Rating of Branch Circuit Fuses
1	3.3	14	½	‡ 15	1.7	14	½	‡ 15
1½	4.7	14	½	‡ 15	2.4	14	½	‡ 15
2	6	14	½	‡ 20	3.0	14	½	‡ 15
3	9	14	½	‡ 30	4.5	14	½	‡ 15
5	15	12	½	‡ 45	7.5	14	½	‡ 25
7½	22	10	¾	* 60	11	14	½	* 30
10	27	7	¾	* 70	14	12	½	* 35
15	38	6	1¼	* 80	19	10	¾	* 50
20	52	4	1¼	*110	26	8	¾	* 70
25	64	3	1½	*150	32	6	1¼	* 70
30	77	1	1½	*175	39	6	1¼	* 80
40	101	00	2	*200	51	4	1¼	*100
50	125	000	2	*250	63	3	1¼	*125
60	149	200,000 CM	2½	*300	75	1	1½	*175
75	180	0000	2½	*400	90	0	2	*200
100	246	400,000 CM	3	*500	123	000	2	*250
125					155	200,000 CM	2½	*350
150					180	0000	2½	*400
200					240	350,000 CM	3	*500

SINGLE-PHASE INDUCTION MOTORS

	110-Volt				220-Volt			
½	7	14	½	25	3.5	14	½	15
¾	9.4	14	½	30	4.7	14	½	15
1	11	14	½	35	5.5	14	½	20
1½	15.2	12	½	50	7.6	14	½	25
2	20	10	¾	60	10	14	½	30
3	28	8	¾	90	14	12	½	45
5	46	4	1¼	150	23	8	¾	80
7½					34	6	1	110
10					43	5	1¼	125

† In order to avoid excessive voltage drop where long runs are involved, it may be necessary to use conductors and conduit of sizes larger than the minimum sizes listed above.

Branch-circuit fuses must be large enough to carry the starting current, hence they protect against short-circuit only. Additional protection of an approved type *must* be provided to protect each motor against operating overloads.

‡ For full-voltage starting of normal torque, normal starting current motors.

* For reduced-voltage starting of normal torque, normal starting current-motors and full-voltage, starting of high-reactance, low starting current squirrel-cage motors.

METHOD OF DETERMINATION OF ELECTRICAL LINE LOSS

Used when meter is located an appreciable distance from the pump motor

Watts equals $I^2 R$ per line.

Kilowatts or kw equals $I^2 R$, divided by 1,000. R equals the resistance of one line.

For 3-phase circuit kw equals $3 I^2 R$, divided by 1,000.

R equals the resistance in ohms for wire size used.

I equals the full load current of the motor.

Full load current of the motor should be obtained from the name plate on the motor.

See tabulations at right for values of R.

For more accurate determination use the same value of R and determine I by use of an ammeter in the circuit.

After determining the total kw loss, subtract this figure from the kw input to the motor.

DIAMETER AND RESISTANCE OF STANDARD ANNEALED COPPER WIRE

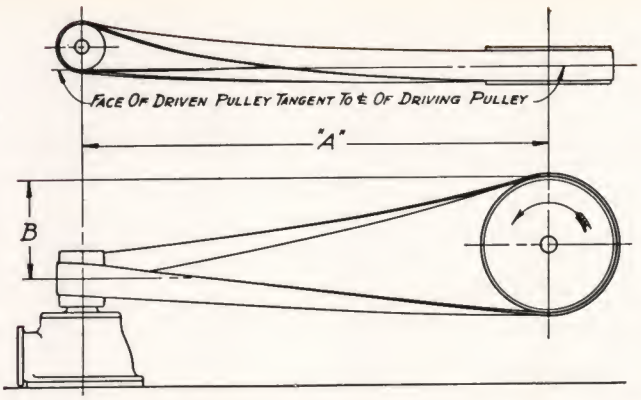
(Round Solid Conductor)

(Based on U. S. Bureau of Standards)

No. A.W.D.	Diameter Circ. Mils	Resistance at 25° C (77° F) Ohms per 1,000 Feet
0000	460	.04998
000	410	.06302
00	365	.07947
0	325	.1002
1	289	.1264
2	258	.1593
3	229	.2009
4	204	.2533
6	162	.4028
8	129	.6405
10	102	1.018
12	81	1.619
14	64	2.575

QUARTER-TURN BELT DRIVES

(Leather and Rubber)



To allow for belt sag, drop the center of the face of driven pulley below the top edge of driving pulley ¾″ for each foot of center to center distance, as shown at "B."

BELT SPECIFICATIONS

hp	Leather Belts		Rubber Belts		Minimum Centers "A"	
	Width	Ply	Width	Ply	Motor Drive	Engine Drive
10	4″	1	5″	3	10 Ft.	15 Ft.
15	5″	2	5″	4	12 Ft.	18 Ft.
20	6″	2	6″	4	14 Ft.	22 Ft.
30	8″	2	8″	5	16 Ft.	25 Ft.
50	10″	2	10″	5	18 Ft.	30 Ft.
75	12″	2	12″	5	20 Ft.	34 Ft.
125	16″	2	16″	6	24 Ft.	37 Ft.
175	20″	2	24″	6	27 Ft.	40 Ft.
225	24″	3	30″	7	30 Ft.	42 Ft.
300	30″	3	*		32 Ft.	43 Ft.
400	36″	3	*		35 Ft.	45 Ft.

MINIMUM RECOMMENDED PULLEY DIAMETERS:

For Single Ply Leather Belts 5″ Dia. For Three Ply Rubber Belts 6″ Dia.
For Double Ply Leather Belts 7″ Dia. For Four Ply Rubber Belts 7″ Dia.
For Triple Ply Leather Belts 14″ Dia. For Five Ply Rubber Belts 10″ Dia.
For Six Ply Rubber Belts 12″ Dia.
For Seven Ply Rubber Belts 14″ Dia.

*Rubber Belting Not Recommended.

Above ratings are based on 4,500 fpm belt speed. For lower speeds reduce ratings for any given width of belt in direct proportion to reduction in speed.

SETTING UP THE DRIVE

1. MINIMUM CENTER DISTANCE – On quarter-turn drives of the type shown in Figure 1, a belt length should be chosen which will give a minimum center distance of 5.5(D+W), where D is the diameter of the large sheave and W is the width of the band of belts. See Figure 3.

2. DIRECTION OF ROTATION – The rotation must be such that the tight side of the drive will be on the bottom.

Set a horizontal driveR (motor or engine) so that the bottom of the driveR sheave moves away from the driveN vertical shaft. Place belts on the vertical shaft to get the rotation needed. (Figure 1.)

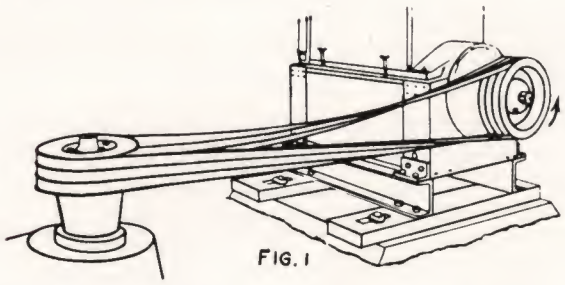


FIG. 1

Set a horizontal driveN machine so that the bottom of the driveN sheave moves toward the vertical driveR shaft. Place belts on the vertical shaft to get the rotation needed.

3. ALIGNING THE DRIVE—Looking down on the drive, a line from the center of the vertical shaft should pass through the center of the face of the sheave on the horizontal shaft, and the horizontal shaft should be at right angles to this line. See Figure 2.

Looking at the side of the drive (Figure 3), the center of the horizontal shaft should be raised a distance "Y" above a level line through the center of the face of the sheave on the vertical shaft. See Table I for the value of "Y" for your drive.

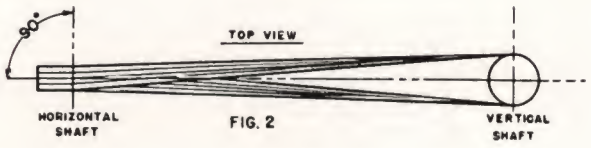


FIG. 2

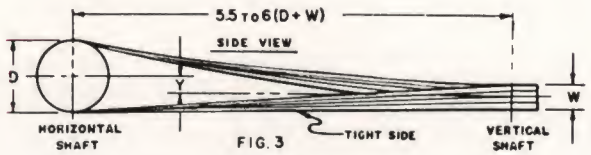


FIG. 3

TABLE I

Center Distance (Inches)	Dimension "Y" (Inches)	Center Distance (Inches)	Dimension "Y" (Inches)
60	2½	160	6½
80	2¾	180	7¾
100	3	200	9
120	4	220	10½
140	5¼	240	12

4. ADJUSTING THE TENSION – Be sure that the belts are snug before you start the drive.

Adjust the tension so that when the drive is running, the middle belt on the slack side of the drive will not fall below its groove in the sheave on the vertical shaft.

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MISCELLANEOUS DATA AND TABLES

WATER REQUIREMENTS

FOR DIVERSIFIED CROPS, INCLUDING IRRIGATION AND RAINFALL

Water Requirement per Acre in Acre-Feet per year. (U. S. Department of Agriculture Technical Bulletin No. 185)

Crop	Tests No.	Lowest General Average	Highest General Average	Crop	Tests No.	Lowest General Average	Highest General Average
Alfalfa	369	3.47	5.08	Milo	35	.96	1.67
Barley	3	1.24	1.83	Millet	5	.91	1.09
Beets (table)	28	.87	1.37	Oats	2	1.90	2.09
Beets (sugar)	5	1.77	2.72	Onions	4	.73	1.52
Broomcorn	9	.97	1.15	Peas	8	1.21	1.56
Cabbage	21	.94	1.49	Potatoes	12	1.59	2.04
Cauliflower	6	1.43	1.77	Rhodes grass	12	3.49	4.43
Carrots	6	1.27	1.60	Snap beans	9	.83	1.44
Corn	42	1.44	1.99	Spinach	12	.80	1.07
Cotton	103	2.35	3.51	Sorghum	34	1.69	2.08
Emmer	6	1.19	1.87	Soybeans	36	1.66	2.81
Flax	3	1.23	1.59	Sudan grass	25	2.88	3.16
Feterita	8	.97	1.10	Sugarcane	41	3.48	4.56
Kafir	16	1.32	1.54	Sweet potatoes	3	1.77	2.25
Lettuce	49	.72	1.35	Tomatoes	17	.95	1.42
				Wheat	46	1.46	2.24

DOMESTIC REQUIREMENTS

Users of Peerless pumps often desire information on private water systems or for domestic use and farm requirements. The following table should be of assistance:

INDIVIDUAL NEEDS	Approx. Gallons per Day
For all household purposes, including kitchen, laundry, bath, etc. (each person)	30
Each cow	10
Each horse	10
Each hog	5
Each sheep	3

LAWN FIXTURES	Gallons per Hour
½-inch hose with nozzle	200
¾-inch hose with nozzle	300
Lawn sprinkler	120
Park or golf course sprinkler covering a 106-ft. diameter area, with ¼-inch main nozzle operating at 50 lbs. nozzle pressure	990

DOMESTIC FIXTURES	Gallons
Filling the ordinary lavatory	1½
Filling the average bath tub	30
Flushing water cabinet closet	6
Shower bath	30

Consumption of individuals and animals will fluctuate with the season and conditions.

In your selection of a pump it is of course essential that a pump of capacity in excess of the actual requirements for any given period be selected. Intermittent operation usually gives the best results.

For example: If sprinkling with ½-inch hose, water consumption will amount to 200 gallons per hour and it is therefore vital that additional water be available for other purposes at the same time.

To accomplish this a pump with a capacity in excess of 200 gallons per hour must be installed. Where ½-inch hose is to be used, Peerless recommends the use of a pump having a capacity of at least 240 gallons per hour. This makes available, for other use, 40 gallons of water per hour. If a ¾-inch hose is being used, which will flow 300 gallons per hour, the pump capacity should be at least 330 gallons per hour.

CONCRETE PROPORTIONS

It is customary to designate the quantities of cement, sand and aggregate (usually gravel) in a concrete by proportions. Thus 1:2:4 means 1 part cement to 2 parts sand and 4 parts aggregate.

Foundations, ordinarily, 1:3:6; sometimes as poor as 1:4:8.
Reinforced walls and beams, 1:3:6; light sections 1:2.5:5.
Foundation walls, 1:2.5:5.5; retaining walls, 1:2.5:5.5 to 1:3:6.
Conduits, drains, sewers, 1:2.5:5.5 to 1:3:6.
Reservoir, filter and tank walls, 1:1.5:3.5 to 1:2.5:5.5.
Underwater work, 1:2:3.

U. S. GALLONS IN ROUND TANKS

For One Foot in Depth

Dia. of Tanks	No. U. S. Gals.	Cu. Ft. and Area in Sq. Ft.	Dia. of Tanks	No. U. S. Gals.	Cu. Ft. and Area in Sq. Ft.
1′	5.87	.785	11′	710.90	95.03
1′ 6″	13.22	1.767	11′ 6″	776.99	103.87
2′	23.50	3.142	12′	845.35	113.10
2′ 6″	36.72	4.909	12′ 6″	918.	122.72
3′	52.88	7.069	13′	992.91	132.73
3′ 6″	71.97	9.621	13′ 6″	1070.80	143.14
4′	94.	12.566	14′	1151.50	153.94
4′ 6″	118.97	15.90	14′ 6″	1235.30	165.13
5′	146.88	19.63	15′	1321.90	176.71
5′ 6″	177.72	23.76	15′ 6″	1411.50	188.69
6′	211.51	28.27	16′	1504.10	201.06
6′ 6″	248.23	33.18	16′ 6″	1599.50	213.82
7′	287.88	38.48	17′	1697.90	226.98
7′ 6″	330.48	44.18	17′ 6″	1799.30	240.53
8′	376.10	50.27	18′	1903.60	254.47
8′ 6″	424.48	56.75	18′ 6″	2010.80	268.80
9′	475.89	63.62	19′	2120.90	283.53
9′ 6″	530.24	70.88	19′ 6″	2234.	298.65
10′	587.52	78.54	20′	2350.10	314.16
10′ 6″	640.74	86.59			

To find the capacity of tanks greater than the largest given in the table, look in the table for a tank of one-half of the given size and multiply its capacity by 4, or one of one-third its size and multiply its capacity by 9, etc.

MECHANICAL AND ELECTRICAL EQUIVALENTS

FLOWING WATER

1 cubic foot per minute = 7.4805 gallons per minute.
1 second foot =
- 1 cubic foot per second.
- 448.83 gallons per minute.

1 second-foot-day = 2 acre feet.

WEIGHTS AND MEASURES

LENGTH

1 millimeter = 0.03937 inch.
1 centimeter = 0.3937 inch.
1 meter =
- 39.37 inches.
- 3.2808 feet.

1 mile =
- 5280 feet.
- 1.60935 kilometers.
- .868 knots.
- 8 furlongs.

Circumference of a circle = 3.1416 × diameter.

AREA

1 acre = 43560 square feet.

$$\text{Area of a circle} = 3.1416 \times \frac{\text{diam}^2}{4}$$

1 acre foot =
- 43560 cubic feet.
- 325900 gallons.

1 barrel = 42 gallons.

VOLUME

$$\text{Volume of a sphere} = 3.1416 \times \frac{\text{diam}^3}{6}$$

WEIGHT

1 gram =
- 1 cubic centimeter of distilled water.
- 15.43 grains troy.
- .0353 ounce.

1 kilogram = 2.20462 pounds avoirdupois.
1 metric ton = 2204.6 pounds.
1 cubic foot of concrete (1:2:4) = 146 pounds.
1 cubic foot of sea water = 63.9 pounds.
1 cubic inch of bronze = .32 pound.
1 cubic inch of cast iron = .26 pound.
1 cubic inch of steel = .28 pound.

EQUIVALENTS OF CAPACITY OR VOLUME FACTORS

1–U. S. Gallon of Water	231.	Cu. inches
1–U. S. Gallon of Water	.1337	Cu. foot
1–U. S. Gallon of Water	8.326	Lbs. at 39° F. or 1.00 Sp. Gr.
1–U. S. Gallon of Water	.833	Imperial gallon
1–U. S. Gallon of Water	3.7853	Litres
1–Imperial Gallon of Water	1.201	U. S. Gallons
1–Imperial Gallon of Water	277.418	Cu. inches
1–Imperial Gallon of Water	9.988	Lbs. at 39° F. or 1.00 Sp. Gr.
1–Cubic Foot Water	7.48	U. S. Gallons
1–Cubic Foot Water	62.428	Lbs. at 39° F.
1–Cubic Foot Water	28.316	Litres
1–Cubic Foot Water	.0283	Cubic meter
1–Lb. of Water	27.71	Cu. inches
1–Lb. of Water	.12	U. S. Gallon
1–Lb.	.4536	Kilogram
1–Litre	.2642	U. S. Gallon
1–Litre	.22	Imperial Gallon
1–Litre	61.025	Cu. inches
1–Litre	.0353	Cu. Foot
1–Cubic Meter	264.	U. S. Gallons
1–Cubic Meter	220.	Imperial Gallons
1–Cubic Meter	1.308	Cu. yards
1–Cubic Meter	61,028.	Cu. inches
1–Cubic Meter	35.31	Cu. feet
1–Ton of Water (2000 lbs.)	240.2	U. S. Gallons at 39° F.
1–Ton of Water (2000 lbs.)	199.8	Imperial Gallons at 39° F.
1–Second-foot	7.48	U. S. Gallons per Second
1–Second-foot	448.8	U. S. Gallons per Minute
1–Second-foot	646,272.	U. S. Gallons per Day
1–Second-foot	1.	Acre inch per hour approximately
100–U. S. Gallons per Minute	0.223	Second-foot
1,000,000–U. S. Gallons per Day	1.547	Second-feet
1,000,000–U. S. Gallons	3.07	Acre feet
1,000,000–U. S. Gallons per Day	694.4	Gallons per Minute
1–Acre foot	325,851.	Gallons
1–Inch deep on 1 Sq. Mile	2,323,200.	Cu. ft.
Gallons per Minute (Water at 205° F.)		Boiler HP x .072

TEMPERATURE

$$\text{Degrees C} = \frac{5}{9} \times (\text{F} - 32) \qquad \text{Degrees F} = \frac{9}{5} \times \text{C} + 32$$

PRESSURE

1 atmosphere =
- 760 millimeters of mercury at 32°F.
- 14.7 pounds per square inch.
- 29.921 inches of mercury at 32°F.
- 2116 pounds per square foot.
- 1.033 kilograms per square centimeter.
- 33.947 feet of water at 62°F.

1 foot of air at 32°F. and barometer 29.92 =
- .0761 pound per square foot.
- .0146 inch of water at 62°F.

1 foot of water at 62°F. =
- .433 pound per square inch.
- 62.355 pounds per square foot.
- .833 inch of mercury at 62°F.
- 821.2 feet of air at 62°F. and barometer 29.92.

1 inch of water 62°F. =
- .0361 pound per square inch.
- 5.196 pounds per square foot.
- .5776 ounce per square inch.
- .0735 inch of mercury at 62°F.
- 68.44 feet of air at 62°F. and barometer 29.92.

1 pound per square inch =
- 2.0355 inches of mercury at 32°F.
- 2.0416 inches of mercury at 62°F.
- 2.309 feet of water at 62°F.
- .07031 kilogram per square centimeter.
- .06804 atmosphere.
- 51.7 millimeters of mercury at 32°F.

MECHANICAL AND ELECTRICAL UNITS

1 btu =
- 1054 watt seconds.
- 777.5 foot pounds.
- 107.5 kilogram-meters.
- .0003927 horsepower hour.

1 foot pound =
- 1.3558 joules.
- .13826 kilogram-meter.
- .001286 btu.
- .03241 gram calorie.
- .000000505 horsepower hour.

1 horsepower =
- 745.7 watts.
- .7457 kilowatts.
- 33,000 foot pounds per minute.
- 641,700 gram calories per hour.
- 273,743 kilogram-meters per hour.
- 2,547 btu per hour.

1 joule =
- 1 watt second.
- .10197 kilogram-meter.
- .73756 foot pound.
- .239 gram calorie.
- .0009486 btu.

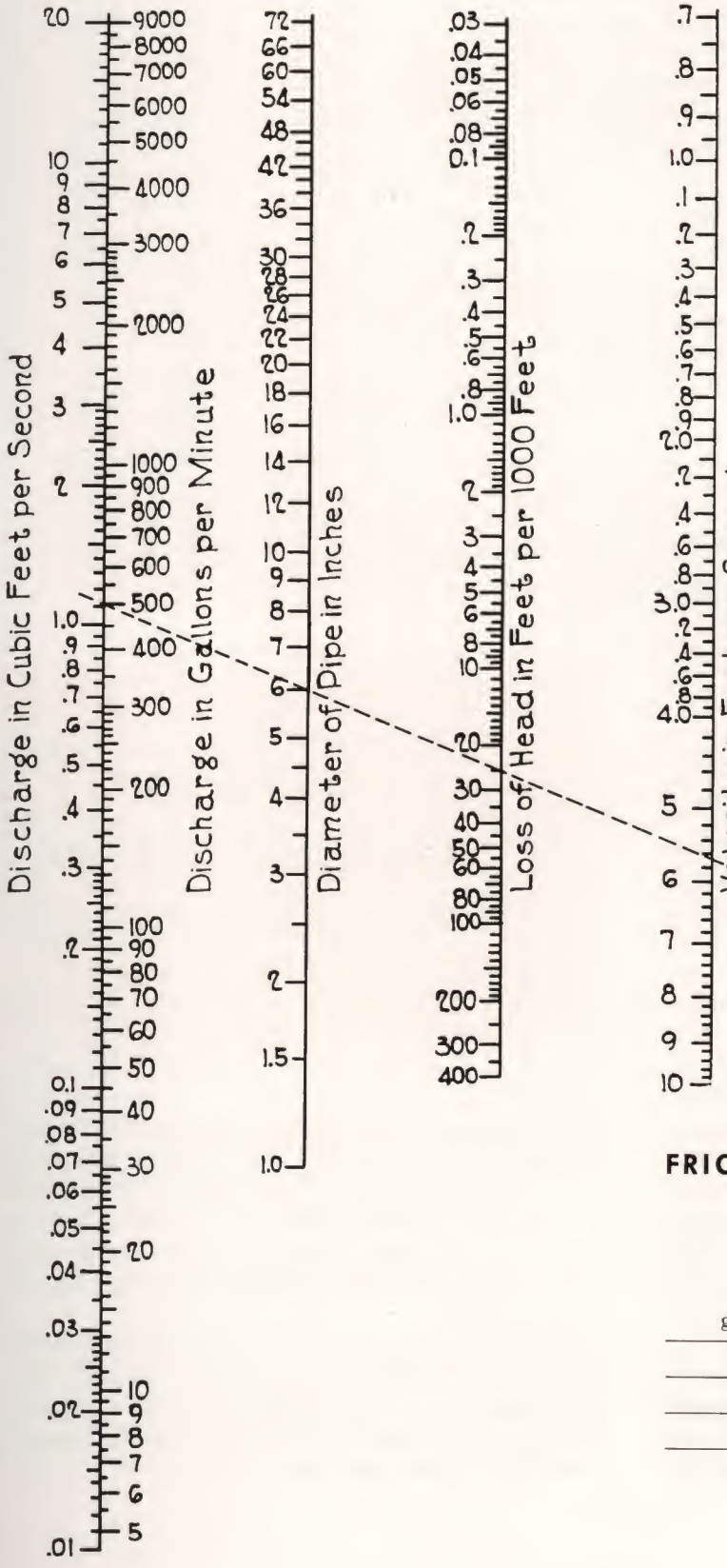
1 kilogram-meter =
- 7.233 foot pounds.
- 9.806 joules.
- 2.344 gram calories.
- .0093 btu.

1 kilowatt =
- 1000 watts.
- 1.341 horsepower.
- 2,655,200 foot pounds per hour.
- 860,500 gram calories per hour.
- 367,000 kilogram-meters per hour.
- 3,415 btu per hour.
- .102 boiler horsepower.

PIPE FRICTION LOSS CHART

DIAGRAM FOR CALCULATING PIPE SIZES, DISCHARGE VELOCITIES AND LOSS OF HEAD IN STANDARD STEEL PIPE

(For Cast Iron and Concrete Pipes See Note at Right)



Lay a straightedge on scales at the points for any two known quantities and the unknown quantities will lie at intersection of the straightedge with the other scales.

Example: To discharge 500 gals. per minute through 6″ pipe, following dotted line would show loss of head in a thousand feet of approximately 25 feet head and velocity of 5.7 feet per second.

Note: Loss of head in Cast Iron Pipe = loss of head in steel pipe multiplied by 1.5.

Loss of head in Concrete Pipe = loss of head in steel pipe multiplied by 2.

When pipe is somewhat rough add 10% to loss of head; when very rough add 25%.

FRICTION OF WATER IN SMALL PIPES

Loss of Head in Feet Due to Friction Per 100 Feet of Smooth Straight Pipe

gpm	½ Inch Pipe	¾ Inch Pipe	1 Inch Pipe
2	7.57	1.93	0.595
3	16.0	4.08	1.26
4	27.3	6.94	2.14
5	41.2	10.5	3.24

AIR LINE METHOD OF DETERMINING DEPTH OF WATER LEVEL

To determine the distance to water in a well, install a ¼ inch pipe or copper tube of known length, 10 to 20 feet below the low pumping level. Make all joints air tight with white lead or piping compound. Connect air pump through tire valve and tube to an air gage.

Pump air into the line until the indicated air pressure is constant. This indicates that all the water has been expelled from the pipe. The gage reading shows the pressure necessary to support a column of water of a height equal to the depth that the pipe is submerged.

FACTORS

X = depth to water in feet (required).

Y = length of air line in feet (known).

Z = Air line water pressure (pressure gage reading). This must be in feet of water. Should gage read in pounds, then convert to feet by multiplying by 2.31.

X = Y — Z.

Example:

Assume air pipe is 100 feet long from center of gage to bottom end of pipe. Also, that the highest gage reading is 20 lbs.

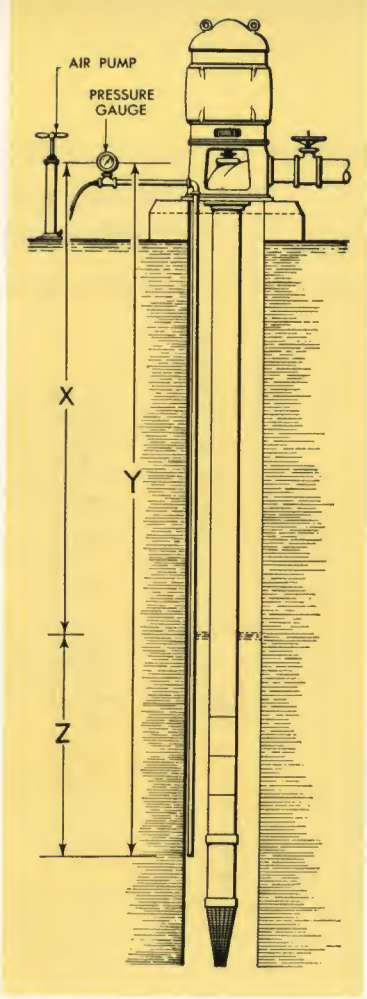
Then,

Y = 100 ft.

Z = 20x2.31 = 46.2 ft.

X = Y—Z = 100—46.2 = 53.8 ft.

depth to water in well.



TYPICAL HYDRO-PNEUMATIC PRESSURE SYSTEMS

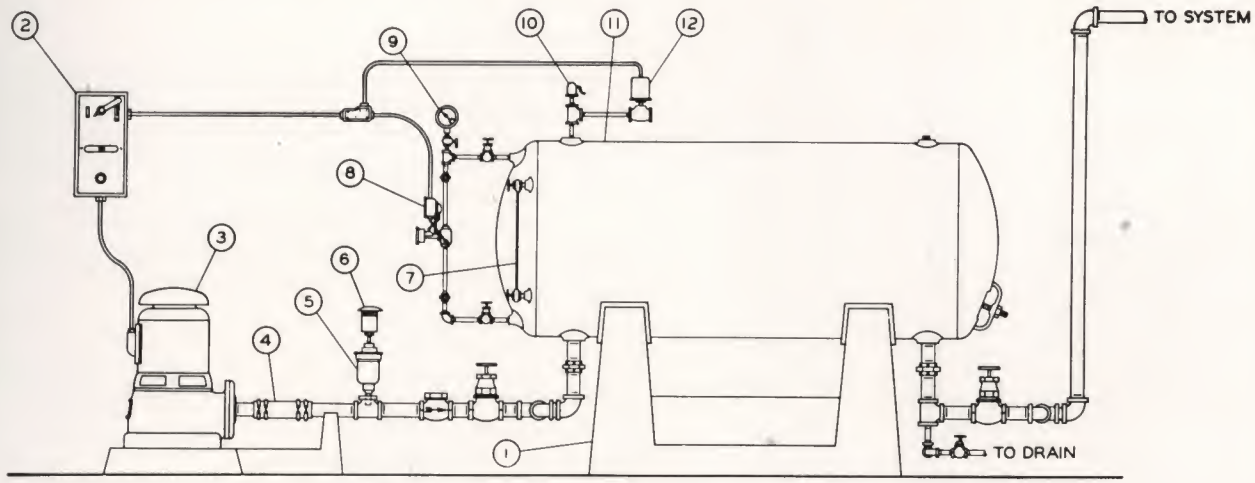
All types of hydro-pneumatic pressure systems have a basic common sequence of operation. When water is demanded by the system, the air in the pressure tank expands to force tank water into the line to replace that being used. In expanding, the air decreases in pressure. When sufficient water is withdrawn from the tank, the pressure is reduced to a predetermined value coinciding with the minimum operating pressure requirement for the system. At this time the pressure switch is actuated to close the electrical circuit which starts the pump motor and the pump forces sufficient fresh water into the tank until the air is compressed to a value equal to the maximum operating requirement for the system. The pressure switch is now actuated to open the electrical circuit which stops the motor. Thus, what is known as a PUMPING CYCLE is completed.

An air volume control is connected to the pressure tank in a position where it establishes the predetermined high water level consistent with the best tank efficiency for the system pressure differential selected and therefore simultaneously maintains the proper amount of air in the tank. Each time air is supplied into the pressure tank, an AIR CYCLE is completed. It is readily observable that some types of systems require an air cycle with each pumping cycle while other systems may have multiple pumping cycles for each air cycle.

There are numerous methods for accomplishing the function of supplying and maintaining air in the pressure tank but we will describe only the sequence of operation for the methods illustrated on the following typical system drawing.

TYPICAL DEEP WELL PUMP TYPE PNEUMATIC PRESSURE SYSTEM

WITHOUT FOOT VALVE ON PUMP SUCTION;
WITH STANDARD DUAL PRESSURE AND HIGH WATER LEVEL CONTROL



1—TANK SADDLES
2—COMBINATION STARTER
3—DEEP WELL PUMP
4—RUBBER HOSE CONNECTION
5—FLOAT VENT VALVE
6—AIR FILTER
7—WATER GAUGE
8—AUTOMATIC DUAL PRESSURE AND LEVEL CONTROL
9—PRESSURE GAUGE
10—PRESSURE RELIEF VALVE
11—PRESSURE TANK
12—SOLENOID VALVE

SEQUENCE OF OPERATION:

The water in the pump column (3) drains back into the well after each pumping cycle and is replaced by atmospheric air which enters through the float vent valve (5). At the beginning of each pumping cycle most of this air is again vented to the atmosphere. Only the amount entrapped in the discharge line by means of the vent pipe, which extends down to the tee connection, is forced into the pressure tank. The amount of entrapped air is regulated to be always in excess of that required by the tank.

The float operated air volume control which is part of the dual valve control (8) operates to open the solenoid valve (12) and allows the surplus air in the tank to escape. When the float rises to the established high water level required by the tank it again operates to close the solenoid valve and prevents any additional loss of air. The system is then ready for the next pumping cycle.

DESIGN CONSIDERATIONS

Experience indicates that there are many hydro-pneumatic pressure systems now in operation which are working under adverse conditions because no thought had been given to the possibility of increased system demand occasioned by future expansion. Almost all public utility services, especially water supply, are constructed with primary consideration being given to future expansion, but for some reason, the same thought has not been extended to the pressure systems which are practically an extension of the primary service. May we suggest that serious consideration be given to the possible future requirements when a new hydro-pneumatic pressure system is being engineered. This suggestion becomes especially important when the water supply is taken from a deep well because the capacities of both the well and the pump must then be considered. Most of the existing unsatisfactory deep well pump systems can be made into satisfactorily operating installations by converting them into combination type systems, which utilizes a booster pump in addition to the deep well pump to fulfill the requirements of the pressure tank.

There are three other types of pressure systems in addition to the deep well type and the combination type. They are the shallow well domestic system type, the booster type and the cushion type. All five of these types of pressure systems, together with detailed descriptions and illustrations of their components, determinations of capacities and pressures and their auxiliary equipment necessary to successful operation are completely described and illustrated in a comprehensive 30 page technical bulletin "Hydro-Pneumatic Pressure Systems," published by Peerless Pump Division, FMC. A copy may be obtained by requesting Bulletin No. B-579.

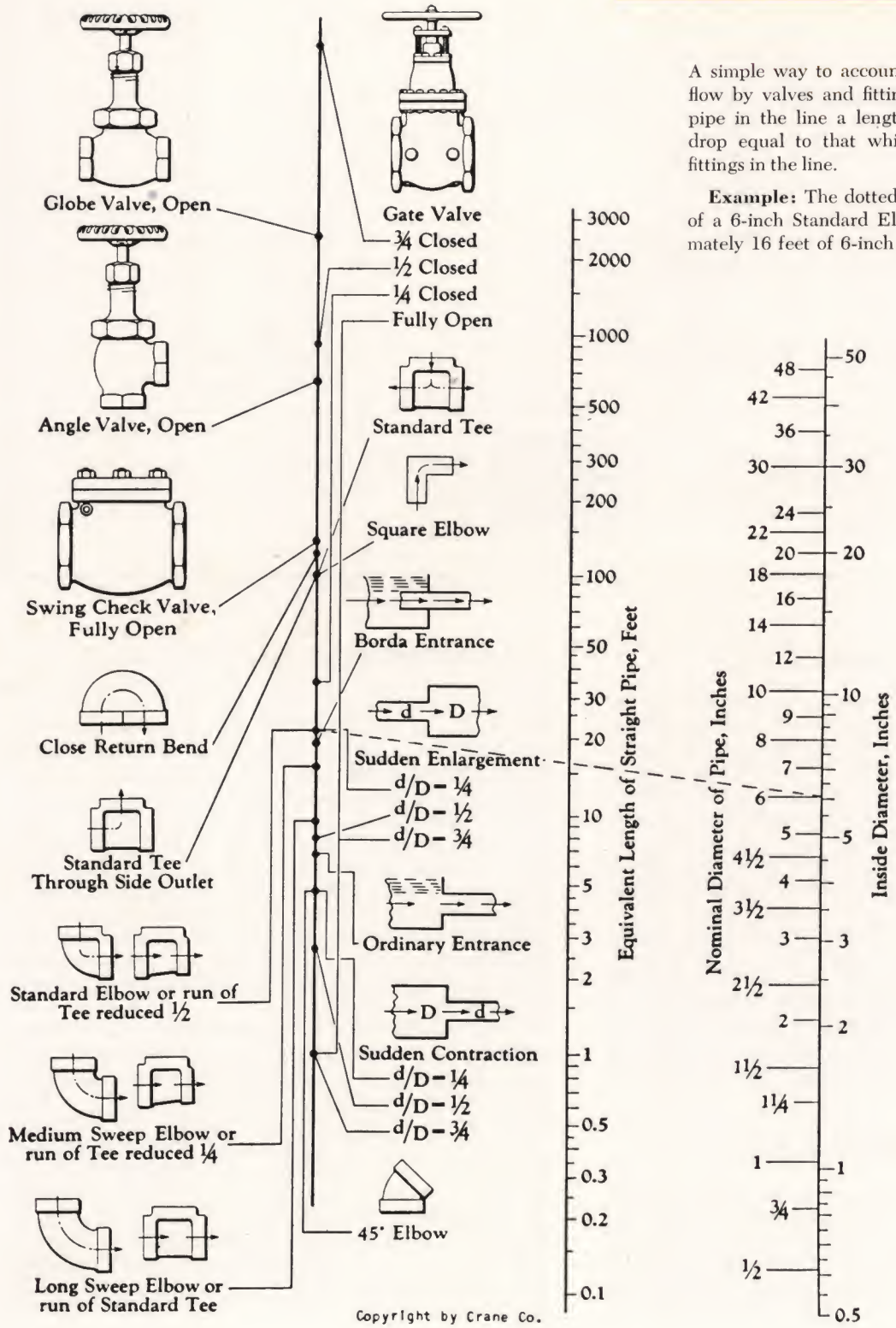
RESISTANCE OF VALVES AND FITTINGS TO FLOW OF FLUIDS

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A simple way to account for the resistance offered to flow by valves and fittings is to add to the length of pipe in the line a length which will give a pressure drop equal to that which occurs in the valves and fittings in the line.

Example: The dotted line shows that the resistance of a 6-inch Standard Elbow is equivalent to approximately 16 feet of 6-inch Standard Steel Pipe.

Note: For sudden enlargements or sudden contractions, use the smaller diameter on the nominal pipe size scale.



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FOR INFORMATION

Should all the postcards which were attached for your convenience in requesting additional information on Peerless Pumps be used up, your request for further information should be directed to:

Peerless Pump Division, Food Machinery and Chemical Corp., 301 West Avenue 26, Los Angeles 31, Calif.

FOR CATALOG

If you or your associates wish additional copies of this Peerless Catalog, please direct your request on company letterhead to the above address.

Give name, title, company affiliation and complete address of those for whom you are making the request.

THESE CARDS ARE FOR YOUR CONVENIENCE

Use them to request additional information. No postage is required when card is mailed in the United States.

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FOOD MACHINERY AND CHEMICAL CORPORATION
Los Angeles 31, California

☐ I would like additional information on products described on page _____ of your Catalog No. B-127.

☐ I have a specific pumping problem and would like you to forward name and address of nearest Peerless representative, or distributor.

NAME _____ TITLE _____

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COMMENTS: _____

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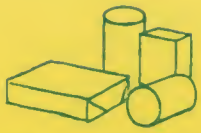
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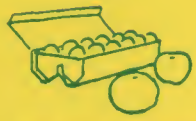
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Canning Machinery Division: San Jose, Calif.[a]; Hoopeston, Ill.

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Peerless – Tisa S. A.: Monterrey, Mexico
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